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Transactions of the Section on Preventive Medicine and Public Health of the ...

American Medical Association. Section on Preventive Medicine and Public Health, American Medical Association

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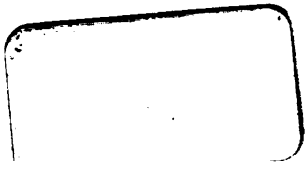

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TRANSACTIONS OF THE

SECTION ON

Preventive Medicine and Public Health

of the
American Medical Association
at the Sixty-Third Annual
Session, held at Atlantic City,
N. J., June 4 to 7, 1912

AMERICAN MEDICAL ASSOCIATION PRESS
CHICAGO: NINETEEN HUNDRED AND TWELVE

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LIST OF OFFICERS

Those named below have served as officers in this section. This branch of the practice of medicine has been included with other subjects in the earlier years, as will be seen by the headings which denote the different names given to the section. The names of the officers have been taken from the published records which are deficient in some cases. It will be appreciated if any additional data are brought to the attention of the Secretary of the American Medical Association.

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1868 Record wanting.
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Secretary, H. M. Bracken, Minneapolis.
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Vice-Chairman, Rosalie Slaughter Morton, New York.
Secretary, C. Hampson Jones, Baltimore.
Delegate, W. A. Evans, Chicago.
1912 Chairman, Guy L. Kiefer, Detroit.
Vice-Chairman, W. F. Snow, Sacramento, Cal.
Secretary, C. Hampson Jones, Baltimore.
Delegate, M. P. Ravenel, Madison, Wis.

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PROCEEDINGS OF THE SESSION

TUESDAY, JUNE 4—AFTERNOON

The Chairman, Dr. Rupert Blue, called the meeting to order at 2:21 p. m.

Dr. Blue then read his Chairman's address and oration. Discussed by Dr. Rosalie Slaughter Morton, New York.

Dr. Le Grand Powers, Washington, D. C., read a paper on "Standardizing Health Board Statistics." Discussed by Drs. William F. Snow, Sacramento, Cal.; Alexander C. Abbott, Philadelphia, and Le Grand Powers, Washington, D. C. During the discussion Dr. Snow moved the adoption of a resolution, which was carried, as follows:

Moved that a committee be appointed by the Chairman of the Section, to consist of those who now are or who have in the past been actively identified with the administration of our municipal and state health departments, to cooperate with the officials of the Bureau of Census and with any committee that may be appointed by the Association of Municipal Health Officers to arrange a scheme of standard or uniform accounts and reports of municipal departments of health, and that the paper submitted this day by Dr. L. G. Powers of the Bureau of Census be respectfully referred to said committee for careful consideration.

The Chairman appointed Drs. W. F. Snow, San Francisco; W. A. Evans, Chicago; H. M. Bracken, Minneapolis; G. T. Schwartz, Providence, R. I., and C. H. Jones, Baltimore, as the committee.

Dr. Rosalie Slaughter Morton, New York, presented the following:

WHEREAS, The resolution passed by this Section on June 29, 1911, relating to the establishment in colleges of a course on practical sanitation has not been officially brought to the attention of the Council on Medical Education, I move that the delegate of the Section be instructed to present this resolution to the Council on Medical Education, and to report to this section on Thursday, June 6, 1912, at 9 a. m.

Motion duly seconded and carried.

Dr. H. M. Bracken, Minneapolis, presented motions: (1) for the appointment of a Committee on Resolutions; and (2) for the appointment of a Nominating Committee; which were duly seconded and carried.

Dr. J. W. Kerr, Washington, D. C., had a paper on "The Desirability of Uniform Methods of Procedure in Quarantine Practice, Especially as Relates to the Minor Infectious Diseases," which was read in his absence by Dr. W. C. Rucker, Washington, D. C. Discussed by Drs. Alexander C. Abbott,

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Philadelphia; G. T. Schwartz, Providence, R. I.; B. Franklin Royer, Harrisburg, Pa.; William F. Snow, Sacramento, Cal.; George Frederick Reinhardt, Berkeley, Cal., and Mr. William A. Howe, Albany, N. Y.

The Chairman then announced his appointments for following: (1) Committee on Nominations: Drs. C. A. Harper, Wisconsin; George W. Stoner, New York, and G. F. Reinhardt, Berkeley, Cal. (2) Committee on Resolutions: Drs. J. F. Hurty, Indianapolis; M. P. Ravenel, Madison, Wis., and Otto P. Geier, Cincinnati.

Dr. William F. Snow, Sacramento, Cal., read a paper on "A Cost-Finding System for Health Departments." Discussed by Drs. Alexander C. Abbott, Philadelphia; Pauline M. Townsend-Hanson, Marshalltown, Ia.; W. C. Rucker, Washington, D. C.

Dr. C. Hampson Jones, Baltimore, adverted to Dr. Kerr's paper of the morning and presented a motion for the appointment of a committee of three, Dr. Kerr as chairman, to study the question of quarantine and report at the next annual meeting; which motion was seconded and carried.

Dr. M. Solis-Cohen, Philadelphia, read a paper on "Reporting of Suspicious Cases by the Laity, a Prerequisite for the Efficient Control of Communicable Diseases." Discussed by William A. Howe, Albany, N. Y.; Drs. Walton Forest Dutton, Carnegie, Pa.; Otis B. Nesbit, Valparaiso, Ind.; Le Grand Powers, Washington, D. C.; Martin Friedrich, Cleveland; Creighton Wellman, New Orleans, La.; Pauline M. Townsend-Hanson, Marshalltown, Ia.; Arthur R. Reynolds, Chicago; M. Solis-Cohen, Philadelphia.

Dr. Walton Forest Dutton, Carnegie, Pa., read a paper on "Laws Relative to the Sanitary Control of Public Eating- and Drinking-Places."

Dr. Guy L. Kiefer, Detroit, read a paper on "The Control of Contagious Diseases in a Municipality."

These two papers were discussed by Drs. Pauline M. Townsend-Hanson, Marshalltown, Ia.; Otto P. Geier, Cincinnati; Seneca Egbert, Philadelphia; Mary Dunning Rose, New York; Walton Forest Dutton, Carnegie, Pa.; Guy L. Kiefer, Detroit, and Mr. William A. Howe, Albany, N. Y.

Wednesday, June 5—Morning

The Chairman appointed Drs. Kerr, Abbott, Royer, Kiefer and Wellman as a Committee on Uniform Methods of Procedure in Quarantine Practice, to report at the 1913 meeting.

The Chairman stated that a number of resolutions adopted last year at the Los Angeles session had been referred to the House of Delegates with favorable recommendation, but the House had not acted thereon; that, therefore, it would be necessary to take them up for final disposition, with request to the House to take action.

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C. Hampson Jones, Baltimore, moved the readoption of said resolutions and their reference to the House of Delegates; which motion, being duly seconded, prevailed.

W. A. Evans, Chicago, as delegate from the Section to the House of Delegates, asked for instructions concerning the continuance of the midwinter Conference on Health as held last February in Chicago. G. T. Schwartz, Providence, R. I., moved that the delegate be advised that the Section desired that the midwinter meeting be not continued. Motion adopted.

The following papers were then read as a Symposium on Industrial Diseases in a joint meeting with the American Association for Labor Legislation, Mr. Henry R. Seager, president of that organization, in the chair.

Dr. W. Gilman Thompson, New York: "Classification of Occupational Diseases."

Dr. J. A. Fordyce, New York: "Occupational Skin Diseases."

Dr. Charles L. Dana, New York: "Occupational Nerve and Brain Diseases."

Dr. Ellice Alger, New York: "Occupational Eye Diseases."

Dr. Mark D. Stevenson, Akron, Ohio: "Occupational Eye Diseases and Accidents."

Dr. David L. Edsall, Boston: "Industrial Poisoning."

Mr. Henry R. Seager, New York, read a paper on "The Need of Cooperation in Promoting Industrial Hygiene."

The seven papers in this symposium were discussed by Dr. A. M. Harvey, Chicago; Mr. C. C. Curtis, New York; Mrs. Florence Kelly, New York; Dr. C. F. Stokes, Surgeon-General, U. S. Navy; Dr. Pauline M. Townsend-Hanson, Marshalltown, Ia.; Mr. Miles M. Dawson, New York; Prof. S. M. Lindsey, New York; Allen Starr, New York; Dr. Otto P. Geier, Cincinnati; Dr. W. F. Dutton, Carnegie, Pa.; Dr. Charles S. Prest, Waterford, N. Y.; Mr. Henry R. Seager, New York.

Dr. Warren Coleman, New York, offered the following motion, which was seconded and adopted:

That a petition be presented to the House of Delegates of the Association from the Section on Preventive Medicine and Public Health requesting the appointment of a permanent committee on industrial diseases, to cooperate with the American Association for Labor Legislation in the promotion of the study and prevention of industrial diseases.

Wednesday, June 5—Afternoon

Dr. Robert N. Willson, Philadelphia, read a paper on "Problems of Venereal Diseases." Discussed by Drs. R. E. Ledbetter, Washington, D. C.; Guy L. Kiefer, Detroit; George M. Sternberg, Washington; D. C.; Sarah J. McNutt, New York; Mr. W. A. Howe, New York; Drs. John F. Anderson, Washington, D. C., H. D. Pease, New York; Elnora C. Folkman, Washington, D. C., and R. N. Willson, Philadelphia.

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The following papers were read as a Symposium on Antiseptics and Germicides, at a joint meeting with the Section on Pharmacology and Therapeutics.

Dr. Norman M. Harris, Chicago: "Intestinal Antiseptics." Discussed by Drs. George M. Sternberg, Washington, D. C.; H. C. Wood, Jr., Philadelphia; J. H. M Knox, Baltimore, Md., and N. M. Harris, Chicago.

Dr. John F. Anderson, Washington, D. C.: "The Phenol Coefficient of Certain Disinfectants." Discussed by Drs. J. T. Ainslee Walker, London, England; Tilly, (?) Washington, D. C.; W. F. Snow, Sacramento, Cal.; H. D. Pease, New York; B. J. Dryfuss, New York; E. M. Houghton, Detroit, and John F. Anderson, Washington, D. C.

Drs. Samuel Amberg and J. H. Mason Knox, Jr., Baltimore: "The Influence of Sodium Iodoxybenzoate on Reactions of Inflammatory Character." No discussion.

Dr. J. A. Capps, Chicago: "Effect of Iodids on the Circulation and Blood-Vessels." Discussed by Drs. B. Fantus, Chicago, and J. A. Capps, Chicago.

Dr. H. G. Beck, Baltimore: "The Duodenal Medication of Ipecac in the Treatment of Amebic Dysentery." No discussion.

Thursday, June 6—Morning

The Committee on Nominations reported the following nominations: Chairman and Orator on State Medicine, Dr. H. M. Bracken, Minneapolis, Minn.; vice-chairman, Dr. W. F. Snow, Sacramento, Cal.; secretary, Dr. C. Hampson Jones, Baltimore; delegate, Dr. A. W. Freeman, Richmond, Va., and alternate, Dr. Creighton Wellman, New Orleans.

Dr. W. A. Evans, Chicago, nominated Dr. Guy L. Kiefer, Detroit, as chairman. Dr. Kiefer was elected Chairman and Orator on State Medicine, and the Committee's nominees, Drs. Snow and Jones, vice-chairman and secretary, respectively. The members of the Executive Committee thus became: Drs. J. N. Hurty, Indianapolis; W. A. Evans, Chicago, and Rupert Blue, Washington, D. C.

Dr. W. A. Evans, Chicago, nominated as delegate Dr. M. P. Ravenel, Madison, Wis., who was elected.

Dr. Pauline M. Townsend-Hanson, Marshalltown, Ia., nominated Dr. Rosalie Slaughter Morton, New York, as alternate.

Dr. Creighton Wellman, New Orleans, the committee's nominee, withdrew in favor of Dr. Morton, who was then elected.

Dr. Pauline M. Townsend-Hanson, Marshalltown, Ia., presented the following:

Resolved, That the program committee be instructed to arrange for a symposium on the relation of poverty to disease and measures calculated to reduce poverty.

The resolution was discussed by Drs. W. A. Evans, Chicago; Creighton Wellman, New Orleans, La.; Pauline M. Townsend-

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Hanson, Marshalltown, Ia.; J. H. White, New Orleans, La.; W. F. Snow, Sacramento, Cal., and Joseph Goldberger, Washington, D. C., and seconded and carried.

Dr. C. E. Ford, Cleveland, moved that the Section's delegate be instructed if possible to bring the meeting of the International Congress on Hygiene, which meets in Washington in September, to the notice of the House of Delegates, or, if impossible, then to the Board of Directors, that the American Medical Association may consider the propriety of taking part in the congress. Motion duly seconded and carried.

Dr. Otis B. Nesbit, Valparaiso, Ind., read a paper entitled "Is Scarlet Fever Carried by Books?" Discussed by Drs. W. A. Evans, Chicago; C. E. Ford, Cleveland; Joseph Goldberger, Washington, D. C., and Otis B. Nesbit, Valparaiso, Ind.

Dr. A. J. Wehr, Baltimore, assisted by S. T. Powell, Baltimore, read a paper on "Purification of Water-Supplies for Small Towns" (illustrated by stereopticon). Discussed by Drs. C. Hampson Jones and A. J. Wehr, Baltimore.

Drs. William Royal Stokes and F. W. Hachtel, Baltimore, had a paper on "A Preliminary Report on the Treatment of Baltimore Drinking-Water with Calcium Hypochlorite" (read by Dr. Harry W. Stoner, Baltimore). Discussed by Drs. M. L. Holm, Lansing, Mich.; and S. T. Powell, C. Hampson Jones, and Harry W. Stoner, all of Baltimore.

Dr. Otto P. Geier, Cincinnati, read a paper on "The Application of Medicosociology in Civic Betterment." Discussed by Drs. Rosalie Slaughter Morton, New York; W. A. Evans, Chicago; H. M. Bracken. Minneapolis; C. Hampson Jones, Baltimore; M. P. Ravenel, Madison, Wis.; J. N. Hurty, Indianapolis, and Otto P. Geier, Cincinnati.

Dr. Eleanora S. Everhard, Dayton, Ohio, chairman of the Committee on Public Health Education Among Women, presented a synopsis of the report of the committee to the Council on Health and Public Instruction [given in THE JOURNAL, June 8, p. 1810].

Dr. Allan J. McLaughlin, Washington, D. C., had a paper (read by Dr. W. C. Rucker, Washington, D. C.) on "Relation of Interstate Waters to the Spread of Typhoid." Discussed by Drs. H. M. Bracken, Minneapolis, and W. C. Rucker, Washington, D. C.

Dr. J. S. Neff, Philadelphia, read a paper on "Local Typhoid Outbreaks." No discussion.

Dr. Rosalie Slaughter Morton, New York, stated that the Section had referred the resolution regarding the establishment of a course in practical sanitation, endorsed by the Section in 1911, to the Council on Medical Education, and called on the Secretary to read the report received by the Section. The secretary read the report. Discussed by Drs. R. S. Morton, New York; H. M. Bracken, Minneapolis; W. F. Snow, Sacramento,

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Cal.; J. N. Hurty, Indianapolis; Jane L Berry, New York, and Oscar Dowling, Shreveport, La.

W. F. Snow, Sacramento, Cal., moved "That it be the sense of this Section that Dr. Morton, the Vice-Chairman of this Section, be requested to present this matter vigorously before the Council, and to request those members of the Section that she may desire to join her in this presentation," which motion duly seconded, was carried.

Dr. Oscar Dowling, Shreveport, La., read a report and resolution relating to inspecting and scoring the cleanliness, etc., of "bakeries and other food-supply establishments, as follows:

To-day health rules and regulations are based on scientific experiments, and it is not intelligent to permit laxity in their enforcement. No man has a right to jeopardize the health of his neighbor. Health is the nation's principal asset; disease its most expensive liability. Health opens to the individual the perspective of success and happiness; it is the foundation on which social efficiency rests; it is the basis of national prosperity and permanence. The public, from apathy, indifference or ignorance, suffers conditions intolerably bad in bakeries, dairies, markets and other food-supply establishments, as well as in barber shops, hotels, restaurants, doctors' and dentists' offices and other places where the health and comfort of people are looked after.

For most of these regulations score-cards have been provided by the health boards of various states. We believe that every physician should be a teacher of hygiene and sanitation; we further believe and recommend the adoption of a score-card and enactment of laws or rules and regulations by the different state boards looking to an enforcement of these regulations.

Resolved, That the Section recommend to the House of Delegates for adoption the following score-card for recording inspections of physicians' offices.

Name.....
Address.....
No..... Date.....19..

	Perfect.	Allowed.
EQUIPMENT		
Location	2	....
Surroundings	2	....
ARRANGEMENT		
Necessary rooms	1	....
Conveniences	1	....
CONSTRUCTION		
Floor	2	....
Walls	1	....
Ceiling	1	....
Light	1	....
Ventilation	2	....
Screens or fans	2	....
WATER		
Hydrant (3); stationary (1).	3	....
Kind and quality:		
Hot	5	....
Cool	5	....
Drinking-water and glasses:		
In cooler (2); otherwise (1)	2	....
STERILIZER	3	
Instruments	4	....
Library	4	....
Furniture	4	....

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	Perfect.	Allowed.
JOURNALS		
National (2); state (1); for three others (2)	5	....
METHOD		
Cleanliness:		
Floor	3	....
Furniture	2	....
Walls	2	....
Ceiling	1	....
Doors	1	....
Windows	1	....
Good condition	2	....
Freedom from flies	2	....
Freedom from bad odor	1	....
Instruments	4	....
Tables (operating)	2	....
Chairs (operating)	2	....
Sterilizers	2	....
Sinks and lavatory	3	....
Toilets	3	....
Disposition of old dressings, etc.	3	....
Personal appearance of attendant	2	....
PHYSICIAN		
Cleanliness of hands and finger-nails	4	....
Personal appearance and breath	6	....
General health	4	....
	100	....

After discussion by Drs. Arthur R. Reynolds, Chicago, and Oscar Dowling, Shreveport, La., the resolution was adopted and referred to the House of Delegates for approval. [The House of Delegates approved the resolution and referred it to the Council on Health and Public Instruction with a recommendation for early and favorable action.]

Dr. Oscar Dowling, Shreveport, La., presented "Report of Committee on Venereal Diseases," and moved that it be sent to the proper committee. Carried.

Thursday, June 6—Afternoon

Dr. Lesley H. Spooner, Boston, read a paper on "Antityphoid Inoculation: Three Years' Experience with Its Use in Training-Schools for Nurses in Massachusetts."

Dr. F. F. Russell, Washington, D. C., read a paper on "Typhoid Vaccination in the Army."

Dr. Frank W. Hachtel read a paper by himself and Dr. Harry W. Stoner, Baltimore, entitled "A Further Report on the Preventive Inoculation Against Typhoid in Public Institutions and in Civil Communities."

The three papers of this symposium were discussed by Drs. M. P. Ravenel, Madison, Wis.; Malcolm C. Rose, New York; C. J. Hunt, Harrisburg, Pa.; Lesley H. Spooner, Boston; F. F. Russell, Washington, D. C., and Harry W. Stoner, Baltimore.

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Dr. W. C. Rucker, Washington, D. C., read a paper on "The Necessity for Rodent Extermination in American Seaports." No discussion.

Chairman Blue introduced his successor, Dr. Guy L. Kiefer, Detroit, asking him to preside for the remainder of the session. Chairman-Elect Kiefer accordingly took the chair and expressed his appreciation of the honor conferred in his election.

Dr. Richard Cole Newton, Montclair, N. J., read a paper on "A Short Discussion of Some of the Recent Hygienic and Economic Improvements in Dairying." Discussed by Drs. Arthur R. Reynolds, Chicago; Malcolm C. Rose, New York; J. J. Kindred, New York; Joseph Goldberger, Washington, D. C.; M. P. Ravenel, Madison, Wis., and Richard Cole Newton, Montclair, N. J.

Dr. C. J. Hunt, Harrisburg, Pa., read a paper on "Results of Epidemiologic Studies of Infection by Typhoid-Colon-Dysentery Groups" (illustrated by stereopticon). Discussed by Drs. C. Hampson Jones, Baltimore; Richard Cole Newton, Montclair, N. J.; A. Parker Hitchings, Glenolden, Pa., and C. J. Hunt, Harrisburg, Pa.

Dr. M. P. Ravenel, Madison, Wis., presented a paper not listed on the program on "The Hygiene of Swimming Pools." This paper was offered after the program had gone to press. It was moved that as the author was present with the paper but as there was not time for the reading the paper be read by title, in accordance with the By-Laws, Chap. XII, Sec. 3. Seconded and carried.

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THE PROBLEM OF THE PUBLIC HEALTH

RUPERT BLUE, D.Sc., M.D.,
Surgeon-General, U. S. Public Health and Marine-Hospital Service
WASHINGTON, D. C.

When the historian of the future records the accomplishments of the decade in which we are now living, he will no doubt call it "the sanitary renaissance," the period marked by a wide-spread desire to improve the conditions under which men and women work and live, an era in which our truly altruistic profession has instituted and led a movement for the physical salvation of mankind. We must not be blind to the fact, however, that we have sometimes confused change for the sake of change with real progress and that our impatience has sometimes obscured the main object of our quest. This does not apply solely to medicine, for whether it be in religion, politics, or public health, it sometimes seems as though all the enthusiasm is on the side of the champions of change. But not all change is progress and not all progress is change. The economic principles which govern us to-day were not born of sudden inspiration but are the product of countless centuries of slow and painful evolution. Every organized institution or effort which has profoundly influenced the race for good has been brought about by slow processes and has not been produced as a *de novo* creation. Real progress has followed the plan of building from a basic nucleus, of carefully erecting the superstructure on a foundation which has stood the stress and strain of time and service.

No better example of this principle can be found than in the way in which the public health institutions

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of our country have been built up from the simple colonial quarantine to the chain of working sanitary bodies of the nation, the state, the county and the municipality. No better or more hopeful prophecy for their continued usefulness and future improvement can be found than in the contemplation of the gradations which have been followed in this evolutionary process.

The colonial period brought forth an attempt on the part of the various ports and cities to exclude and eradicate pestilential disease. This was a local, unorganized, and non-uniform movement, too often influenced by commercial motives and civic pride, but the seed of preventive medicine thus sown took root, and one of the first bills introduced into the First Congress of the United States provided for the assumption of the quarantine power by the federal government. But the time was not ripe, and we passed through a long period of state and local quarantine, and not a few devastating epidemics, before the citizenship had evolved to the point where it would impose these duties on the general government. Even then we were unprepared for the step, and the short-lived national Board of Health came and went, but not before it had touched with prophetic finger the heart of the problem of the public health, the state and local boards of health. In a republic where the right to govern rests on the consent of the governed, where public sentiment very largely influences the enforcement of sanitary law, where people think before they obey, the cornerstone of the whole public health fabric is the state board of health, and its efficiency determines in large measure the efficiency of the whole.

Coincident with the development of the state boards came the improvement of the federal health agencies. The national Board of Health was a *de novo* creation springing fully formed from the brains of a number of the most brilliant and public-spirited medical men of their time. The principle on which it was founded,

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however, was not accepted at the time and it fell to the ground of its own weight. In the meantime a small body of men were plodding steadily along the public health path; studying exotic disease in the hospital; wrestling with the wraiths of pestilence in fever camps; learning in the solitude of isolated quarantines the management of our coast defenses against disease. Congress gradually recognized the work of this body and by the enactment of laws enlarged its functions and powers. From this source came the Public Health and Marine-Hospital Service.

A great deal has been said recently about a national department of health. The logic of this seems to me to be so apparent as to need no defensive argument. But much as a strong federal bureau of health is required and earnestly as we must strive for its accomplishment, the great problem lies in the improvement of the state and local health agencies, in the extension of their powers and the increase of their appropriations. The key to the solution of the problem lies in education, the simultaneous education of both the leaders and the led. The great universities are now providing for the training of competent health officers, and various public-spirited medical bodies are acting in cooperation with the sanitary authorities as teachers of the adult public. This agitation is largely the result of the continued efforts of the American Medical Association for the past sixty-five years, and its wisdom is apparent, because no law can be effectively enforced which is not in accord with public sentiment. This has been conclusively demonstrated in recent years in the various campaigns for the suppression of epidemic disease in this country. Plague was not eradicated from San Francisco, in 1907, until the public had been educated by lectures and newspaper articles and their cooperation thus obtained. Similarily the yellow fever suppressive measures during the New Orleans epidemic of 1905 would have failed of the highest accomplishment, in

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the broadest sense, had not the public conscience been quickened by the thorough inculcation of the mosquito dogma.

But we are not waiting for epidemic outbreaks of disease to make necessary such eleventh-hour sanitary conversion. The common schools now teach elementary hygiene; the colleges supplement this earlier instruction with more advanced obligatory courses, and the fruition of these labors will carry us a long way toward the sanitary ideal. The reaping of this harvest is an affair of the future; the immediate and crying need is the enlargement of the scope of the state boards of health. Many of these are already doing work of a high standard of excellence, but in some states they are merely skeleton organizations with little power and small appropriations for the task which confronts them. Too frequently their laboratory facilities are inadequate, and research work is entirely out of the question. Next to a highly trained personnel, the most important thing in a state health organization is an efficient diagnostic laboratory to which medical practitioners may send specimens for examination. This service should be extended free of charge, and physicians, particularly in the rural districts, where laboratory facilities are usually very meager, should be encouraged in every way to avail themselves of this means of accurate diagnosis. This reacts to the improvement of the public health not only in the benefit received by the individual patient but also because an increasing accuracy of the morbidity and mortality statistics is made possible thereby. This means an increase of the registration area, a line of extension in which it is hoped the federal bureau of health may be able to assist.

We should not, however, be content to have these laboratories employed solely in the performance of routine work. There is a great and varied field for research open to us and as no two states have exactly the same problems confronting them, an extension

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along the line of original investigation promises results of world-wide benefit.

Laboratories and an extension of duties on the part of state boards of health cost money. The guardianship of the public health is an obligation of such great importance that the personnel of the sanitary department should be the most highly competent men available and they should be paid accordingly. There has been in the past a policy of parsimony in this regard—in fact, in all health appropriation matters — which has seriously impeded sanitary progress. This is most short-sighted. Every dollar spent on health boards should be regarded as an investment and not an expense, and be it said to the credit of these boards that they are run with a smaller wastage of funds than any other institution of the government.

Those experienced in public health work know how extremely difficult it is to secure adequate appropriations and suitable laws for even the simplest sanitary problems with which we have to deal. This is partly because of the reputation of our profession for making bricks without straw and partly the fault of the method of presenting the case to the people's representatives. In the final analysis, it is a simple business proposition, a form of health insurance. To be sure, it is pretty hard to buy good health back, once it has been allowed to get away, but once possessed, it is merely an economic problem to maintain it. This is the duty of the health bodies which are in close touch with the people. The plan of organization of our sanitary agencies, modeled as it is on the scheme of the nation, recognizes this fact. When our forefathers founded the republic, the rights of the states from the interference of federal control was guaranteed, and it is now recognized that "the power of the federal government begins where the power of the state government ends."

Federal interference with the right of a state to administer its own health measures would scarcely be

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tolerated unless it could be shown that some extraordinary condition prevailed, and even then, such service could be rendered only at the request of the state in question. This clothes the central sanitary organization with advisory powers except in such matters as concern all the states, or the relations of one state to another state or to the outside world. It also imposes certain executive functions, such as the collection of vital statistics, the administration of the quarantines between the states or between our country and foreign countries, and the control of such products as would affect the health of a large mass of the people, for example, the toxins, antitoxins and viruses.

It will be seen from this that there are great limitations to the activities of the health department of the general government. It was intended from the beginning that the federal departments should take over only such functions as could not be relegated to the states. The Department of State, the Department of War, the Department of the Treasury, the Postoffice Department, the Department of the Interior—all of these are peculiarly governmental departments, and it is with the affairs of the central government that they are concerned. But the health of this nation is in the main the health of the various states, and to their care must be entrusted much of the machinery of its promotion. This is the most vital aspect of the public health problem.

There has always been a great deal of confusion in the minds of persons who have not studied the matter deeply as to the sanitary powers of the federal government; many persons are prone to think that a department of health, with a secretary in the President's cabinet, would accomplish a great deal in solving public health problems. Our legislators have therefore wisely determined that the public health interests, in so far as the government can control them, shall be entrusted to a bureau whose personnel is composed of trained sanitarians. The bureau of health at Washington is

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capable of great expansion, and when so enlarged, it can do a great deal more than it is now doing for the betterment of sanitary conditions in the states.

The present Secretary of the Treasury has evinced an interest and sympathy for the advancement of health interests not heretofore shown by any of his predecessors in office. This is a splendid beginning, and we may expect a greater liberality in appropriations and the granting of additional powers from time to time by Congress.

Few persons, even in our own profession, are aware of the organization which already exists, and the triumphs which it has achieved in the field of preventive medicine. There is no nation in the world which has a more efficient sanitary corps, and if you would build a department of public health, you have here a foundation of proved worth which is capable of an enormous advancement if you but lend it your aid. This bureau needs your support, and the sanitarians of this country need its help.

I believe that this spirit of mutual dependence should be developed. Changes in methods and forms are sometimes necessary, but in changing to meet the needs of the present, the builders should see to it that they are selecting a firm foundation of correct principles which will not fall in the future. The first of these principles, and the one which should receive our hearty support, is that of mutual dependence, "one for all and all for one," between the federal, state, county and municipal health authorities, and the medical profession as a whole.

Such cooperation has received the sanction of law by the Act of Congress of July 1, 1902. It should also receive the seal of approval of the medical profession to the end that our endeavors be correlated and harmonized, and that all of the agencies for the protection of the public health may come together beneath the broad banner of the movement for the public weal. And thus we may be fulfilling the saying that "all things work together for good. . . ."

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REPORTING OF SUSPICIOUS CASES BY THE LAITY A PREREQUISITE TO THE EFFICIENT CONTROL OF COMMUNICABLE DISEASES

MYER SOLIS-COHEN, A.B., M.D.
PHILADELPHIA

The more or less effective regulations to protect the public from persons afflicted with a contagious disease are naturally enforced only in cases that are reported to the health authorities. The unrecognized case is subjected to no restrictions at all; the recognized but unreported case only to those the family voluntarily observes.

It has been my belief that the spread of contagious disease occurs chiefly through the unreported and particularly the unrecognized cases. Until every case is brought under the control of the health authorities no real progress will be made toward limiting or stamping out communicable disease.

UNREPORTED CASES

For each reported case of notifiable disease there are many unreported. Some physicians even make a practice of not reporting their cases, for which very reason they are employed by families who desire to avoid restrictive measures. A premium is thus placed on dishonesty, the physician who evades the law gaining practice at the expense of the honest practitioner. It is foolish to expect all medical men to report their cases of contagious disease so long as no effort is made to find out and punish those who violate the law.

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In many instances, especially when the attack is a mild one, no physician is consulted, lest he report the case. The mother herself treats the patient with home remedies. This is true particularly of secondary cases, in which treatment is carried out according to the directions the physician gave in the primary case. Naturally many mistakes of diagnosis are made, the most serious being the mother's mistaking mild scarlet fever for measles or rubella, or even a stomach rash.

Persons who would not object to have the disease reported often dispense with a physician for financial reasons when the patient is only slightly ill. Such cases without medical attention could be brought to the notice of the health authorities if, in the absence of a physician, the parent or householder were required to report notifiable diseases, as they are now compelled to report a birth.

UNRECOGNIZED CASES

The most potent source of contagion in my opinion is the unrecognized case; for the family usually takes some precautions in regard to a recognized case that is not reported. Even a physician sometimes fails to recognize a contagious disease, especially when it occurs in a mild or atypical form. Without a culture, for example, it is practically impossible to diagnose latent diphtheria. In most instances, however, the fault lies with the parent, who does not regard the condition as sufficiently serious to warrant sending for a doctor.

Thus it is that large numbers of children with mild or latent diphtheria are looked on as suffering from sore throat or tonsillitis and, instead of being isolated, attend school, frequent moving-picture shows and mingle freely with their playmates, inoculating many who thus become carriers or who may even have the disease in typical clinical form, and these children never know how they contracted the disease. I have already gone into this subject more fully.[1]

1. Solis-Cohen, M: Latent Diphtheria; a Public Health Problem, THE JOURNAL A. M. A., July 6, 1907, p. 30; Diphtheria Carriers, Their Discovery and Control, THE JOURNAL A. M. A., Jan. 9, 1909, p. 111.

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In like manner numerous persons with unrecognized scarlet fever walk about the streets and attend school, especially during an epidemic of measles or rubella. Many of these cases are never known; some are discovered merely by accident. To illustrate, I shall recite the accidental discovery by me in one month of eleven cases of scarlet fever during an epidemic of measles.

May 21, 1911, I was sent as medical inspector to examine a child who was reported by the attending physician as having scarlet fever, but whom the ambulance physician had pronounced not to be suffering from the disease. After confirming the attending physician's diagnosis, I inquired if anyone in the house had been sick recently, and was shown two children who were said by the mother to have had measles. Both were desquamating. On asking if there were any cases of rash or measles in the neighborhood, I was referred to two children in a house on the next street, who were supposed to have had measles, but whom I found in active desquamation. Had a third case not developed in the first house, these four cases probably never would have been discovered.

Three weeks later, June 14, I was sent to examine a child reported by the attending physician as having a suspicious case of scarlet fever. The physician had not been summoned for the general illness but for an infected burn produced by a home-made mustard plaster. I made a diagnosis of scarlet fever and, inquiring for other instances of recent illness in the house, found a child of another family in bed on another floor, supposedly suffering from measles but really in the eruptive stage of scarlatina. I also obtained a history of three other children in the house having been successively attacked with measles during the previous two months, but on examining two who had been ill six and eight weeks before, respectively, could find no evidence of desquamation. The third child being in school, I examined her there and found her hands peeling. She was

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living temporarily with a married sister whose baby she said had had the measles, but whom I found to be convalescing from scarlet fever. These four cases would probably never have been known had one patient not been burned by a home-made plaster. As it was, two additional patients with probable scarlet fever got well without recognition.

How easy it is to miss the mild case that often starts an epidemic may be seen from the following instance, which occurred a few months later: Two children developed a rash but were not very sick and received no medical attention. Half a block away a case of scarlet fever developed, no one knowing how the disease was contracted. Five days later a case of scarlet fever was reported from the house where the two children had been indisposed. While making a report on this latter case, I learned of the illness of the other two children and examined them, finding evidence of desquamation in both.

Measles and rubella, especially when occurring in a mild form, frequently fail of recognition, being called "strawberry rash," "stomach rash," "spring rash," "ivy poisoning," "hives," and the like. Mild attacks of mumps of short duration, with very slight enlargement of the parotid gland and no distress on eating sour things, are usually overlooked or regarded as "swollen glands," "glandular fever" or an "ulcerated tooth." Sometimes chicken-pox is unrecognized. Until the "whoop" develops, parents as a rule pay little attention to whooping-cough. Seldom in these various instances is a physician consulted.

Is it any wonder that health officers are disappointed at the high incidence of preventable communicable diseases despite the most modern methods of combating them? How can anyone expect that the control of a mere fraction of the total number of cases of contagious diseases will do much toward stamping them out? Be the isolation of the reported cases ever so thorough,

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infection still proceeds from those who are going about unrestricted with unreported and unrecognized cases. All efforts to stamp out communicable diseases must necessarily fail until the public health authorities gain control of all the cases.

Is there any way by which the unrecognized and unreported cases can be brought under the supervision of the public health authorities? Is such a thing not impossible? I believe it to be not only possible but practicable. Nearly every case of illness is known to a number of persons, who usually also are aware when there is a suspicion of its being contagious.

REPORTING OF SUSPICIOUS CASES

Many of the cases not reported to the health authorities are reported to other public officials. The vast majority occur among school children or in their homes, a large proportion during the school term. In such cases the parent often notifies the school of the child's illness, sometimes giving the name of the disease. When this is not done it is customary for the teacher or principal to send word to the parents asking the reason for the child's absence. In many cities an attendance officer visits the home to learn why the child is not in school. It would be a perfectly easy matter for teacher, principal or attendance officer, on learning of the existence of a contagious disease, to report the case to the health authorities, who thereupon might investigate. Even when such disease is only suspected, the report of a suspicious case might be made, giving the grounds for the suspicion. This would include all cases of rash under any name, rumors brought by the school children, and unexplained or inadequately explained absences, especially during an epidemic. In schools having medical inspection the case might first be referred to the school doctor, who would decide whether the facts warranted the case being reported to the public health authorities as suspicious.

Neighbors as a rule know what is going on in each others' homes. The recognized but unreported cases of

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which they have no knowledge are, indeed, few. Of the suspicious cases they also usually have cognizance. Most persons, however, dislike telling on their neighbors for fear of incurring annoyance or inciting enmity. Some even side with their friends against the sanitary officials.

It nevertheless is my belief that if the laity were educated to realize the danger to themselves and their families as well as to others of the uncontrolled case, and the insidiousness of the unrecognized case, if they were frankly told that the prevention of communicable disease is possible with their aid and impossible without it, and if, moreover, they were taught to regard it as a civic duty to give this aid in the protection of the public health, their cooperation could be obtained. But then the responsibility would be on the sanitary authorities to see to it that the good do not suffer while the evil escape. It would be their duty to enforce the laws against all and to prosecute those who break them. They will know when a physician has failed to report a case and they will be expected to hold that physician strictly to account. And should a law be passed requiring the householder to report contagious and suspicious cases occurring in his house, they must proceed against all who are found violating that law. For the cooperation of the public is not to be hoped for in any unfair administration of the law that subjects those who comply with it to restrictive measures which those who disregard it are permitted with impunity to escape.

Without the aid of the laity I believe it is impossible to stamp out communicable diseases. With their active assistance I have little doubt that it will be possible to prevent most of the contagious diseases which hitherto have not been effectively controlled.

4102 Girard Avenue.

ABSTRACT OF DISCUSSION

MR. W. A. HOWE, Albany, N. Y.: We are coming more and more to believe and to know that most of our communicable diseases are transmitted by carriers—that it is not so fre-

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quently the bedridden patient who is transmitting disease, as the person with unrecognized disease. Here as elsewhere in our work we must conduct an active campaign of education to teach, through the family physician, the parents of these carriers and many dangers incident to the prevalence of such disease. There is but one way to reach them—not through the neighbor, as I do not believe it is either right or neighborly to expect a neighbor to report clandestinely the presence of communicable disease in the next-door family, but through the family physician, who should place in the hands of the mother, proper literature explaining the danger of these diseases, their extensive prevalence in these mild forms, and the imminent danger of spreading fatal infection to others. We must teach them the necessity of giving better attention to the convalescent, and the absolute necessity of proper isolation, however mild the affection may seem to be, until the child ceases to be a carrier.

Dr. Walton Forest Dutton, Carnegie, Pa.: It seems to me that the general practitioner receives much more censure than is his due, as regards the report and care of these diseases. The laws should be enforced, but the blame should be placed where it belongs. If local health authorities were prompt in doing their duty, the physician and the state could cooperate with distinct advantage to both. It does not avail anything for the physician to report diphtheria, scarlet fever, etc., unless the sanitary regulations are carried out by the local health authorities. A great many boroughs have an ordinance which is a modification of the state laws. This ordinance does not comply, in full, with the state law. Therefore the physician is not enabled to do his full duty to the state. I concur with what has been said by Dr. Cohen. The reporting of suspected cases is a prime necessity. We can very often detect measles on the mucous membrane of the soft palate and other parts of the buccal cavity one or two days before the eruption appears. The same may be said of diphtheria and scarlet fever.

Dr. Otis B. Nesbit, Valparaiso, Ind.: The health officer too frequently goes and tacks up a card and calls that quarantine, and then asks: "Why don't people report quarantinable diseases?" A good many cases are not reported because the family cannot afford to be quarantined. The wage-earner cannot afford to be shut out of the house and be compelled to pay for board some place else. Or, the regulations may be such that he may be shut up in the house and be compelled to stay there and no one in authority visits the family to provide its needs.

This is the most important question, I have found locally, in enforcing quarantine. First, tell your people what quarantine means; second, a demonstration of this idea of quarantine in a humane manner; and when you get your people

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to understand that that is what you are doing, you will get contagious disease reported. Physicians will not report cases, because they say: "I know the poor devil couldn't afford it; and I would rather call it a strawberry rash; it is mild, and does not amount to anything anyway." If the authorities are properly caring for those quarantined, the physician will report his cases.

We have not been treating them just right, in some localities, and when we stop mistreating the unfortunate citizen we shall not have much trouble about getting reports. Then also our knowledge is so indefinite. We know so little about these diseases; and we have been guessing so much. In Indiana, we asked the state board of health last year to make a uniform quarantine regulation; and now we are sorry we did it, because they went to work and made a minimum quarantine on scarlet fever of twenty-one days, and there are a few towns maintaining a quarantine of six weeks, which I do not think long enough for an arbitrary time limit; and we have neighbors around us that quarantine the minimum of twenty-one. We are reaping the benefits from their short quarantine by their citizens visiting friends in our city immediately after release from quarantine and communicating the disease to the citizens of our city. Quarantine regulations should be the same in all counties, in all states and in all nations.

MR. LEGRAND POWERS, Washington, D. C.: One of my youngest children was taken sick on a Saturday morning. Scarlet fever was not suspected; by Monday the child was fairly well and went back to school. A week later another child was taken sick and we sent for the doctor, who pronounced that second case a case of scarlet fever; by that time the first child was beginning to show signs of having had the disease the week before.

We must recognize the fact that there are multitudes of cases among the less educated that correspond to this case among the fairly well educated family. In some way or other, through our board of health, we must carry home to the average family the knowledge that they could detect these hidden cases and so do their part as citizens in lessening the spread of contagion.

DR. CREIGHTON WELLMAN, New Orleans: It seems to me that a principle which should be recognized in a discussion of this question is that when a disease is to be considered as reported, all suspicious cases of this disease should be reported to the local board of health. A following out of this simple principle will answer many of the objections which have been brought against the thesis presented by Dr. Cohen. In New Orleans, the board of health has a requirement that unreportable diseases and all suspicious cases should be reported along with the actually diagnosed cases; and the

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physician or the family may call on the board of health to aid in the decision as to whether the given disease which is evidently suspicious is really to be classified as a reportable disease or not.

Dr. Pauline M. Townsend-Hanson, Marshalltown, Iowa: One of the physicians spoke of educating the mothers, by giving literature to the mother who had sick children. The woman who has sick children has no time to read literature—unless possibly in regard to the care of the child—certainly not in regard to the importance of reporting the disease. Most women who have the care of families and households, even though there is no sickness to hinder them will take time to read how to make clothes and to cook and to perform other household duties, but will seldom take time to read dry literature on medical subjects. The mother has not time, unless she belongs to the privileged few of the wealthy class; she has not been trained to an interest in scientific, let alone dry medical, subjects. Comparatively few young American women have the limited amount of scientific education given in our high schools; many of those among the poorer classes, in which more sickness exists because of insanitary conditions, have never even passed through grammar grades, cannot read articles that contain simple medical words. In some talks that I have given to these women I have been simply amazed to find, among those considered fairly educated, almost absolute ignorance of simple medical terms. People will listen to a talk, whereas they will not read the same thing in printed form; when they do not understand they are so reticent they will not ask someone what this or that word means, because they do not want to show their ignorance. Women who will go to the medical talk are but a very small percentage of the women who have to deal with sick ones. Medical education must be developed long before women have the hindrances of household cares; it must be done in the school-room, when the woman is yet a child. We must devise some method of increasing the scientific knowledge given to children through the public schools on health subjects. In addition, it ought to be possible to educate the public by having public health exhibits in our county and state fairs throughout the United States. In Iowa we have baby health contests at the state fair and various county fairs. This interests the public, and the newspapers are glad to give it a great deal of prominence. In the county that I come from, the county fair board has created a public health division, with a superintendent, on the same footing exactly as the other divisions of the county fair. In this division we will have a baby health contest. There will be three classes of competitors and three first prizes. The prize, $10, is higher than that for the hog, cattle or the horse.

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DR. ARTHUR R. REYNOLDS, Chicago: We have given voice to one sentiment here that I want to commend: that is, the hope that contagious diseases will some day be eradicated. It is going to be difficult to accomplish, but that is what we are here for. If any one doubts, let him look back over the mortality list for contagious diseases in the last twenty years. They are diminishing everywhere. Just where the vanishing-point will be I cannot tell.

MR. W. A. HOWE, Albany, N. Y.: As in many other states, in New York we publish various leaflets of instruction on several communicable diseases. These are published in sets, one intended for circulation among health officers and physicians, the other to be used among families afflicted with these diseases. We likewise have individual cards on which to report the various communicable diseases and during the past year in certain sections of the state we have been sending to the various physicians a package containing such leaflets as are published by our department, together with several complete sets of cards on which to report communicable diseases, as well as other literature bearing on public health. At the same time, a personal letter has been addressed to the physicians advising them of material being sent and urging their cooperation in our endeavor to secure complete registration of all communicable diseases, as well as of births and deaths. In this letter the commissioner has urged the physicians to place in the hands of every family in which a communicable disease exists literature relative thereto with a view of informing such families of the true character of such disease and the necessity of complying strictly with certain rules and regulations so necessary for their control. This plan, where tried, has proved very satisfactory, and Commissioner Porter is seriously considering the advisability of extending its application throughout the state.

DR. M. SOLIS-COHEN, Philadelphia: The speaker who said that these diseases should be reported, not through the neighbors, but through the family physician, failed to explain how this could be done in cases of persons having no physician, which represents probably nine-tenths of the minor and one-half of the major contagious diseases; and how that would help where the physician will not report the case, especially if he is kind-hearted and thinks the family cannot afford to be kept home and so pronounces scarlet fever, "strawberry rash," and allows the patient to go about spreading the disease throughout the neighborhood. Did another speaker mean to leave literature at the houses in which there are unreported cases? How shall we know where such houses are? Most boards of health leave literature where cases are reported.

The best place to educate the people is in the newspapers, as practiced by Dr. Evans in Chicago and Dr. Neff in Phila-

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delphia. The American people read the newspapers and look eagerly for these health articles. A person complained to me of a rule of which he was in ignorance, saying that he read the papers faithfully and failed to see any reference to it. The people can also be educated by lectures at county fairs and in school buildings. There are plenty of ways to teach them how important it is that all cases of contagious diseases should be known. As soon as they realize that it is their children who are saved by such methods, I think they will be willing to help. There are many ways in which contagious diseases can be discovered. When a child has been absent from school it is very easy to examine him on his return and see if his hands are peeling, and, if he has had a sore throat, to take a culture. It is possible to have a rule that all sore throats must be cultured. The laity usually knows when there are sore throats about. Even when you educate the people there will always be some who are unteachable, or vicious, or who are unwilling or who feel they cannot afford to be subjected to restrictions. These will not report their cases, no matter how much we teach them; and unless we have some other way, through their neighbors or through the school authorities, we shall never hear of their cases. When the laity are taught that peeling hands probably means scarlet fever and that rashes and sore throats may indicate a mild form of a very serious disease, they will be willing, I believe, to bring such cases to the attention of the health authorities.

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THE ERADICATION OF THE SOCIAL DISEASES IN LARGE CITIES

ROBERT N. WILLSON, M.D.
PHILADELPHIA

No more time need be spent in discussing the possibility or the impossibility of eradicating the contagious social diseases, syphilis and gonococcus infection than in relating their ubiquity or their influence on all classes of society. Suffice it to say that rich and poor, intelligent and stupid, moral, immoral and unmoral, innocent and guilty, are paying the price of centuries of an ignorant, ill-considered false modesty in terms of morbidity and mortality that probably surpass the sum of all other contagious influences combined. If a computation were made of the acute venereal infections, their complications and active sequelæ, the brain and cord lesions, the insanities and idiocies, the inherited and acquired deformities and destructive lesions, the partially and totally blind, the abortions and stillbirths, the operations on the abdomens of innocent as well as of guilty women, the male and female sterility, the army of infant deaths, the apoplexies, the lowered vitalities of those not manifestly diseased, the moral bias and weakness, and the degeneracies of mind and heart directly or indirectly traceable to the so-called social diseases, there would result a seriousness and perhaps a tendency to reflection throughout humankind that would forecast at least a profound upheaval. The physical results form only the beginning of the influence of the social diseases on the world at large. The broken homes, the divorces, the desertions, the suicides, the incapacity for work, the wages lost,

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the hospitals and asylums rendered necessary, the cost of treatment, form only a few of the points at which the diseases of immorality impinge on both the innocent and the guilty portions of society. It seems incredible that up to the present syphilis and gonococcus infection are, officially speaking, non-existent, and that as far as the national and to a great extent the municipal authorities are concerned are deserving only of contempt or complete disregard. In the Army and the Navy alone are they officially recognized by the national government as diseases. The horde of immigrants that enter this country every year is examined for every infection save these two. The accurate and actual cause is placed on the death-certificate, the country over, in every instance save of these two diseases.

There is before us, therefore, a task to which society at large, and especially the medical portion of it, must straightway address itself. The fact that the problem ramifies in and out through animal passion and private and public immorality renders it more difficult, to be sure, but none the less insistent, and none the less finally soluble. Small-pox once appeared hopelessly and permanently beyond control; tuberculosis was only recently regarded with complacent resignation. The social diseases await the same sharp awakening of a people that have been too long asleep, and the application of measures that are within our grasp in spite of all pessimism to the contrary.

AN EDUCATED PUBLIC

In the first place, and absolutely essential to the success of any attempt at controlling influences so insidious as the diseases that are fostered mainly by and through immorality, is the sane, quiet, complete sex-education of the American people. Granted not only a knowledge but a realization, à thorough appreciation of the facts, and radical action will follow, on the part of womankind at least, and eventually from the side of the tra-

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ditionally less virtuous male portion of society. On a health basis only, in my opinion, is the social evil a soluble problem. In a competent knowledge of the existing conditions of the public health lies the first and most radical advance toward society's moral and physical cure. Beginning with the teaching of normal sex hygiene to little children at the mother's knee, through the medium of the flowers, and soon through the lower and then the higher forms of animal life — always emphasizing the sacred duty and privilege of reproducing one's kind, and of equipping the body and mind far in advance for this duty — beginning with this primitive, but essential ground-teaching, we can advance through the public and private school to the later sociologic training of the adult citizen. Not only trained teachers are needed, but intelligently willing parents. We are at least one generation distant from the apparent realization of society's physical and moral cure.

COMPETENT AND WILLING OFFICIALS

An intelligent, open-eyed people will elect to positions of responsibility and trust only such men and women as are committed to the moral and physical health of the public. One of the new requirements of eligibility for mayor of a city will be a candidate's thorough acquaintance with the bearing of prostitution on the phycisal health of the community. He will be required to make in advance an outspoken statement of his attitude toward a continued tolerance of the spread of the social diseases through publicly condoned immorality,— a tolerance that is rendered possible only by the violation of his oath of office in ignoring and failing to enforce existing laws. As a rule these are competent to meet the needs and to insure the protection of the public. Clandestine prostitution furnishes a problem even far more serious than that of public immorality and one that does not come within the responsibility of a city's chief executive. This fact relieves him in no measure from a full

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and far-reaching responsibility for every public brothel that remains open and inviting to the boys and men contrary to law, or for every case of venereal disease carried from such a house into clean homes to infect innocent, ignorant women and children. In my own as in almost every other city the brothels have long stood open wide. In them a large percentage of our boys and men contract and transmit one or both of the two contagious social diseases. This is in the face of the fact that mayor after mayor has sworn to uphold laws already on the statute-books, and only awaiting official willingness to enforce them. These provide for:

1. The quarantining by the board of health of "any person afflicted with any contagious disease dangerous to the community" and for the exercising of "such other powers as shall in their judgment be most conducive to the public good with the least private injury."

2. Enforced hospital treatment if a person afflicted with any contagious or pestilential disease cannot be properly and sufficiently attended at home.

3. The reporting by physicians to the board of health of patients "laboring under a pestilential contagious disease, every person practicing physic in the city shall forthwith make a report in writing to the health office, and for neglecting to do so he shall be considered guilty of a misdemeanor and subject to a fine not exceeding $50."

4. The right to enter and search where there is "just cause to suspect any nuisance to exist."

5. The punishment (*a*) of those keeping a disorderly house; (*b*) of those keeping a bawdy house or leasing a house to be so kept; (*c*) of those committing adultery; (*d*) of those committing fornication.

The enforcement of each and every one of these laws will be necessary to the control of the diseases that spring originally from immorality.

With the cooperation of fearless and intelligently equipped heads of the departments of public health and of public safety, no mayor of either a small or a large city need expect failure as the outcome of a determined and persistent attempt to keep his city clean.

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Clean morals imply clean physical health to a tremendous extent, and in so far as the law empowers him, both the clean physical health and clean moral health of the community depend in the main on the willingness of the chief executive to fulfil the obligations he has pledged himself to perform. There can be no apology for awaiting a demand on the part of the people for protection against dangers which they neither appreciate nor understand. Their safety is a sacred trust devolving on the conscience and intelligence of the chief executive of every city and one that does not lessen in its insistence because the people are still asleep. An unsullied personal character, a keen intelligence, initiative, courage, persistence and patience are prime qualifications and requirements to be exacted of future candidates for the occupancy of a mayor's chair. May the American people soon awaken to their opportunity and to their need!

WHAT CAN THE PUBLIC DO?

The active cooperation of the people with their chosen officials is the ideal method and will no doubt bring the speediest and most thorough result. The people and the officials are not both essential to the success of an intelligently conscientious endeavor. Either can awaken the other, if slumbering, to a sense of duty and inherent power. Either can accomplish much, if necessary, without the aid of the other. In certain of our American cities the immoral and diseased sections have been rendered temporarily clean through the efforts of one man or of the entire body of citizens, in the face of a reluctant mayor and an openly opposing department of police. In such an event the public may have to seek out the facts for itself. It should, if necessary, deliberately investigate its own improvident expenditure of public funds for the care of those physically incompetent through tolerated public immorality. It should not be

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called on, however, to assume the functions of the mayor and his subordinates; but in the delinquency of these officials it may and should take their functions over. The public officials are salaried to protect the public by the enforcement of law. On occasion the public is forced to work and to serve without pay. Publicly condoned prostitution means publicly condoned disease and a consequent civic burden in the form of taxes for the maintenance and care of the feeble-minded, epileptic, orphaned, crippled and paralyzed. It would almost seem that the medical portion of the public would feel it incumbent on itself to render these data easy for the people to obtain. It should encourage a full public understanding of the dependence of these conditions in large measure on immorality and consequent disease.

In default of action by their chosen officials the people should not repeat the mistake of placing unwilling men in places of power. The women of a community should demand also that the double standard of physical and moral health be distinctly condemned by the male sex, if marriage and child-bearing are to be continued by innocent, clean girls. Motherhood should not entail invalidism, the operating-table and an unsexing operation soon after the first child is born. What is more, womankind should see to it that the single standard is adhered to, at least by those men who desire to marry clean girls. No laws are needed for the purpose. Let the mother, or better still the marrying girl, offer her prospective husband a physician's certificate of her own freedom, as far as ascertainable, from transmissible disease, and demand the same from him. His answer will of itself go far toward assuring her of safety or danger. In this step the miracle is already well on its way toward accomplishment, the women and children are in sight of physical safety, and the babies far nearer an enjoyment of their right and title to be born alive and to live.

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MEASURES TO BE AVOIDED

The public should also study and acquaint itself with the facts regarding measures that have invariably invited and just as invariably resulted in failure. These may be considered under three heads: (1) Indisposition, ignorance, inaction; (2) reglementation, including medical examination, and segregation; (3) vice commissions.

Inaction has been the order of the day for centuries, and has centered in male duplicity and willingness to tolerate feminine ignorance and even encourage blind over-confidence in the worthiness of the stronger and less temperate sex. Most cities owe their sorry moral and physical plight to the fact that they are contented in their corruption in spite of knowing that it is only a short step to civic revolution and to the security of a new and real health.

Reglementation, Medical Examination and Segregation have all been put to a thorough test in Europe and in certain sections of this country. In Germany, France, Austria and England, government commissions have reported not only on their inefficacy, but very positively with respect to their influence in increasing the spread of prostitution and the social diseases. No more ample, no more definite evidence can be presented to an intelligent people than has been adduced on this point. Nothing further should be necessary by way of determining the action of a wide-awake nation. We should not require the stroke of a mallet on our collective figurative head. Neither should we encourage a further waste of time and money over methods and means that have once and again been tried and found wanting. Grand juries will be heard, perhaps for years to come, demanding a licensing of prostitution (virtual if not actual) that implies the licensing also of the spread of contagious disease. The people will not indefinitely tolerate such an inane and extravagant recklessness and folly. They cost too dear in

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terms of good American lives and health. This nation can afford to lead the way in any and every effort that promises to insure the safety of her citizens. It must never venture to walk blindfolded or backward into pits and over precipices that have long since been marked with sign-boards by other nations.

Vice Commissions.—I venture to suggest that these are at best a sorry attempt on the part of public officials, from the mayor of a city down, to shift a grave personal responsibility and duty on a long-suffering people. Two memorable vice commissions have made the necessary pioneer investigations and have blazed the way. The fact that they were necessary in their respective cities was a burning disgrace on the executive officers of those communities and on the male sex at large. None the less their work was well done, and their reports have startled all the world except the portions that are still asleep or that do not wish to be shaken out of ignorance and depravity. Cities differ very little with respect to their immoral and diseased sections. Invariably there is a close association between rotten politics and public prostitution. Without a thorough interdependence of these twin evils neither one could continue to exist, because the concealment and misrepresentation that are necessary to the life of the latter would become apparent to the clean portion of the public and action would be prompt and radical.

There can be no question that the people, especially the women, do not yet realize the significance of the present state of affairs. From east to west the only variation is in the extent and degree of publicly tolerated, if not encouraged, prostitution. If the departments of health and of public safety in a given city are alive to their opportunity and duty, they have in hand all the data that are necessary to the cleansing of their own particular charge. Every house of public prostitution and every house of assignation can be and usually is accurately known and registered in the police

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department. The object of this registration varies in the different communities. In not a few it is with the definite purpose in view of levying a toll for revenue that quietly reaches the pockets of individuals in a position to provide protection and immunity, and still more quietly supports a certain type of machine politics that needs no description, because we all know it well. Every public prostitute and street-walker ought to be accurately known to the police officials. Her exit from a particular city is not a matter of difficulty when this end is desired. A definite notice that she is to cease plying her trade, with the realization that the notice requires attention and observance, is all that is necessary. Nor need she return until the authorities desire or permit her reappearance. When all cities take this matter in hand there will be none that will harbor an acknowledged public woman or house of ill fame, nor one that will permit the presence of soliciting men and women — usually foci of contagious disease — on its streets.

There are indeed difficult phases and perplexing features of the prostitution question, but the matter of a full knowledge of the number and identity of the public houses and of their inmates and of the street-walkers, and ridding the cities of all these, are not among those difficulties. An official suggestion that they are constitutes an insult to the intelligence of the people, and amounts to a self-conviction of unfitness for executive office. Moreover, we may rest assured that a vice commission, from to-day on, will from the time of its appointment until its dissolution meet with unnatural conditions in the city which it undertakes to investigate. My own city is at this instant heralding far and wide the fact that its vice commission, just appointed, is about to begin its labors and report on the condition of the town. Meanwhile during the three months since the first announcement that the mayor was waiting for a public demand for a vice commission all types of public prosti-

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tute, house inmate and street-walker, have been quietly and discreetly filtering out of Philadelphia into Atlantic City, Baltimore, Washington, even New York — black and white, male and female — all diseased and transmitting contagious disease, and ready to return to their pursuits shortly after the vice commission has rendered its report on an unnatural and abnormally peaceful state of affairs. In most instances a vice commission must necessarily employ improper and immoral means to obtain the evidence that will convict. When it does not, it assigns to an impossible task a police or detective force that is usually as well known to the public prostitute as the latter is to them. Perhaps as in the Philadelphia journals of yesterday and to-day the personnel, even the names of the officers assigned to detective duty are spread out to public, and of course to prostitute, view. Every item of the work of a vice commission can and should be accomplished more thoroughly, quietly and quickly by an efficient police department serving under a loyal mayor and director of public safety than by a group of citizens, however willing, but altogether ignorant of the first principles of such an investigation as is placed in their charge. The facts are in most instances already in hand; the moral courage to use them is alone lacking.

Official and Departmental Investigation and Control. —These are the forces that must be invoked and applied sanely, persistently and without ceasing. The moment they are relaxed human passion and carelessness of inevitable results will answer for the return of moral and physical conditions that are all too apparently serious to-day. In my opinion no city need harbor either the public prostitute or his or her contagious disease, provided it begin now and continue electing only such public officers as both subscribe to solemn oaths and fulfil their obligations to the public and to humanity.

The public should square itself with the public prostitute and acknowledge that in a large measure it is

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responsible for her sorry state. Social conditions are tolerated and encouraged by many of saintly speech and mien that render it easy if not imperative that the public woman yield to the temptations of passion, vanity, and man's disregard of woman's honor and fair name. Starvation wages, the unattractiveness and poverty of the home, the opportunity of an easy income far larger than that obtainable in an honest or honorable livelihood, a total ignorance of the inevitably early disease and death that attend this calling, the dance-hall, the average theatrical show, the wiles of the procurer and cadet, the long working-hours, the temptation and finery of the department store, the lack of legitimate pleasure and relaxation are the conditions that help, at least, in recruiting the ranks of the 300,000 and more of America's public women, the average length of whose prostitute life is little over five years. The public owes the prostitute something of sympathy, protection, encouragement and of hospital care, at least when she emerges from her low level to an attempt at better things. Her head should not be pushed down again; she should not be refused employment; she should not be raided or imprisoned unless the same treatment is accorded the man. She ought to be taken into God's fresh air under institutional protection and directing care, under ideal conditions, until she can breathe deep and realize that there are human beings still on the earth who have also erred in one or another direction and who are extending to her a helping hand. She has not violated her oath of office as have the mayor and his subordinates who have perhaps allowed her to become morally and physically infected and as a prostitute to spread contagious disease, nor has she yielded in most instances altogether to her own desire. Grim social conditions have oftentimes pressed her down until her weak will has given way in an attempt to reach the only apparent means of relief and escape from intolerable servitude or impending starvation.

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Another mistake that is likely to be made is the overlooking by the citizens of the entire absence and lack of hospital provision for the army of girls and women and boys and men whom any wholesale moral upheaval will throw suddenly on the community. In the state of Pennsylvania there is only one hospital that freely admits for treatment persons suffering from the social diseases as such. Without ample hospital facilities and wards in which to furnish treatment free of charge to all willing to apply, the control of the diseases consequent on prostitution is impossible, and the attempt need not be undertaken with any hope of accomplishment. Such extravagances as the recently proposed placarding of the houses of those infected with the social diseases are ill-advised conceptions of those who are acquainted with neither the social nor the strictly medical difficulties in the way. Victims of syphilis or a gonococcus infection must be encouraged to attempt as speedy and complete a cure as possible, not driven to concealment and the inevitable spread of disease. An exaggerated fear of public exposure means simply and surely an endless chain of infections that will cease only when the social diseases are placed as they should be, in the light of day, beside and in the same category with similar contagions, such as small-pox, typhoid fever and tuberculosis, not one of which compares either in morbidity or indirect mortality with syphilis, or perhaps with gonococcus disease.

SALUTARY SANITARY MEASURES

There are practical measures that are likely to contribute toward final success in the partial or ultimately complete eradication of the social diseases. One of the most important of these is the placing of syphilis and gonococcus disease on the list of the compulsory reportable contagions. California enforces such a provision to manifest advantage. Even New York City provides for limited reporting of these conditions. In no instance is the name of the patient reported to the health

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authorities; simply the fact (by number) that a new case is in the care of the physician, a brief statement of the character of the infection, its origin when possible, and the adequacy of its supervision and care from the standpoint of the public.

Another strictly official health measure should be the provision for a careful and accurate study of the social diseases. Such an investigation must needs be carried on by the authorities to be complete or of any practical value. It could be rendered successful by the use of a questionnaire placed in the hands of every physician in a given municipality.

Side by side with adequate free treatment for syphilis and gonococcus infection should be offered unrestricted opportunities for obtaining a Wassermann test for syphilis, a serum test for gonococcus infection, or a laboratory examination of specimens and slides for the *Spirochæta pallida* and for gonococci. Quarantine regulations can and should be imposed on patients who refuse proper treatment and thereby endanger the public health.

State control hardly seems practicable at the present time though both the state and national authorities should officially recognize the social diseases as grave problems from the standpoint of morbidity and of indirect mortality. Especially in their bearing on mortality among infants and children should they be listed as hereditary contagions, and accurate statistics be sought after. It may be possible within the near future to spread on the statute books laws similar to those already enacted in several of our western states providing for the requirement of a certificate of health prior to the issuance of a license to marry. Such a law would at best be merely an educational power. It cannot be enforced except in so far as the individual physician is conscientious and has an eye single to public duty. This end can be accomplished in even fuller measure by the people themselves when they are of a mind to establish

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the custom of exacting just such a certificate in the absence of a law covering the point.

Another invaluable measure must be the furnishing by every city of all its hospitals with private and free wards for the decent and skilful treatment of syphilis and gonococcus disease. This has already been referred to as absolutely necessary to success.

Another measure might well be the systematic education of all those who probably carry infection, especially of the public prostitute so long as she is an acknowledged member of a community, with respect to her own invariable infectiousness to the public, not only to the men with whom she cohabits, but through them and also independently of them to other and innocent individuals.

Still another would be the posting in the front hall of every building, respectable and otherwise, of the name and address of the owner of the property. If held in the name of a corporation or estate the name of the latter should be displayed. In Iowa an injunction can be obtained against the keeper of a house of prostitution, as well as against the owner of the property. A fine of $300 may be imposed by the court against the property, constituting a tax lien which takes precedence over a mortgage and serves as a cloud on the title. The property is enjoined forever from use for immoral purposes and for one year from use for any purpose whatsoever, except under certain specified conditions.

A fifth would be the formation of definite organizations whose sole aim would be the securing of ample living wages for girls and women for services actually rendered. This step would be an active preventive measure against public prostitution, and still more powerful in the control of the even more serious problem of clandestine immorality which serves as the most active means of spreading the social diseases among the needy working girls, and through them to boys and men.

Sixth, the cities can and should maintain a real home, an outdoor institutional guardianship, not in the

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nature of a penal institution, for wayward girls who need and desire a guiding and directing hand back into physical and moral health. Definite provision should be made for the protection of the public against infected and infectious cooks and table servers (hotel, restaurant and lunch-counter waiters), colored and white; also for a full medical certification as to the freedom of certain classes of household servants, especially of nursery maids and butlers, from transmissible disease. One of the largest railroad systems in the country is of its own volition already insisting on a regular periodic physical examination by the company's medical officer of its entire restaurant station and train force on pain of prompt dismissal in the event of refusal to submit to the inspection. For identical reasons the common drinking-cup, the roller towel, and the public piece of soap, should be forbidden by law. The cities can and should furnish properly managed outdoor gymnasiums, baths, dance-halls and playgrounds, not only for its children but for its young adult men and women. From both of these uncared-for classes come the substitutes that fill the ever depleting ranks of the diseased and dying prostitute.

There remains to be thought out and worked into practical form some plan by which industrial openings and healthy business opportunities may be furnished to such girls and women as evidence a genuine desire to leave either clandestine or public prostitution for useful citizenship. Whether in the form of a large cooperative department industry, or in that of an agency that will quietly but effectively secure from philanthropic business men of the cities positions for regenerate girls of a given community — in whatever form the solution may shape itself, some definite future must be provided or the former unfortunate must remain through society's heartless decree a permanent sinner. Society will pay the price in terms of broken and diseased home life.

Finally, it would not be an impossible thing for the women of a city effectually to demonstrate to the men

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that since prostitution is no longer looked on as a physical necessity for either sex, it must no longer be indulged in by the loyal citizen. A prompt handling of all attempts to entice and solicit on the part of men; the public exposure and summary punishment of all males and females detected practicing any form of prostitution; the oversight of the moral and physical welfare of its boys and girls, at least to the extent of safeguarding and preventing them from easy contact with prostitution and from exposure to the social diseases in public houses of ill fame — lie within the power of the large cities and afford opportunities that should not be overlooked of prevention as by all odds the best and cheapest form of cure. The women and the physicians of a community really have the solution of the prostitution problem within their grasp and control. Both prostitution and the social diseases will begin to disappear the moment the women and the physicians so decree. With power comes the responsibility of *noblesse oblige*. With the new opportunity comes also a shame born of oft-repeated unwillingness and refusal. Only through educated, brave men and women and through the intelligent action of him whom we still love to call the family doctor, will that new body of citizens be reared who will know all the facts, and regard prostitution and its diseases as burning life-problems, and who will not stop short of a radical cure of evils for the continuance of which through their inaction they have been in a considerable measure responsible.

1708 Locust Street.

ABSTRACT OF DISCUSSION

Dr. R. E. Ledbetter, Washington D. C.: Venereal disease is one of our greatest problems in the Navy. Last year, 11,150 men were admitted with venereal diseases or their sequelæ, 191 of whom were totally disabled and had to be discharged from the Navy. Our personnel being about 45,000, it will be noted that approximately 25 per cent. of our

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men were infected during the year. The number of admissions, 11,150, corresponds to the number of men required to man ten first-class battle-ships. We now have compulsory venereal prophylaxis in the Navy, and our results since its institution have been fairly good, and we hope for better results in the near future. Briefly, the method consists of injections of argyrol and local applications of calomel ointment within twelve hours after coitus. Just now the percentage of venereal admissions would appear to be greater than ever before, but this is only apparent and not real, as now the medical officers are reporting every case, whereas in former years, many patients were not reported, as they could still work. We hope with venereal prophylaxis and education to reduce the rate of admission to 25 or 30 per cent. of what it is now. The layman can help us by teaching the public to respect our uniform, and by urging legislation to restore the canteen. This would materially lessen venereal infection in the Navy, as on account of their uniform the men, except in Rhode Island and the District of Columbia, cannot enter a respectable café or theater, and must gravitate to the slums, where many of them contract venereal disease. We are doing all we can to educate our men, and assistance would eventually lesson our venereal problem very much.

Dr. Guy L. Kiefer, Detroit: I hope with Dr. Willson that the time is near at hand when all houses of prostitution will be banished from our cities, but unfortunately this time has not arrived. It may be disgraceful but we must admit that houses of prostitution do exist and that the inmates of these houses do spread these diseases, and while it is maintained by some that this is a small part of the problem, it is large enough. We know from the estimates that have been made that the number of exposures in a city like Detroit, for example, are about 750 in a day from this source. It seems to me that it is necessary for a health department to meet this condition. I do not believe in regulation of houses of prostitution in the sense of segregation and regular examination of the inmates because this has been tried and has failed, but I do believe in the examination of all known prostitutes in a given city by the officials of the department of health at irregular and unannounced intervals, with the proviso that, if any of the women are found to be diseased when these unannounced examinations are made, then the house will be placarded. Such a method will result in the reporting of the cases to the department of health, and the reporting of cases of contagious diseases of any kind is the first step necessary in a campaign for the prevention of such diseases. Whenever cases of venereal diseases are reported to the department of health, the infected persons should be removed at once to a hospital and kept there until their case is no longer infectious.

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DR. GEORGE M. STERNBERG, Washington, D. C.: It seems to me that the most important thing to keep in mind is the educational campaign. If we can show our young men and our young women an exhibit which shows the results of venereal infection and the statistics relating to the prevalence of these diseases, I think it would have a greater effect than any amount of legislation relating to prostitution.

DR. SARAH J. MCNUTT, New York: Much has been suggested as to what should be done with the prostitute woman in order to control venereal diseases. Since it is a well-recognized fact that there are more than twelve prostitute men to every prostitute woman, it would seem neither just nor right that the woman alone should be arrested, examined and, if found infected, retained for treatment, while all the men prostitutes are allowed to go free, and at will to scatter these diseases broadcast throughout the land. If one is examined, retained and treated, so should all be examined, retained and treated.

MR. W. A. HOWE, Albany, N. Y.: It seems to me that the question of prostitution is not the only point where we should attack the prevalence of venereal diseases. To my mind equally as much venereal disease is contracted outside as inside of houses of prostitution. For that reason we should attack both sources of infection, that so frequently are seen as a result of clandestine intercourse, as well as that contracted in houses of prostitution. Here, as in practically every problem of public health, the question resolves itself into one of practical education. It is one thing for us to get together to tell each other that we should educate the people in the suppression of these communicable diseases, but it is quite another matter to determine how we should conduct that education. It is the intention of Commissioner Porter to appoint in the immediate future about twelve prominent women physicians of the state to conduct an active campaign of education among various organizations of women, among working girls, etc., as to the prevalence of venereal diseases and their dangers. A similar line of education will likewise be conducted by a certain number of men physicians who will conduct similar meetings among organizations of their own sex. In our state we have already enlisted the active cooperation of the W. C. T. U., the Y. M. C. A. and various other religious and civic organizations in our crusade of education for the control of venereal diseases. We expect at no distant day to be able to get into the high schools of our state likewise to teach the boys and girls as much of sex hygiene as may be advisable and of material assistance to them in appreciating and escaping the danger of these extensively prevailing diseases.

DR. JOHN F. ANDERSON, Washington, D. C.: It does not seem to me that the placarding of houses of prostitution is

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going to do a great deal of good. It results in the scattering and depopulation of those particular houses.

DR. H. D. PEASE, New York: All my educational efforts have been confined to the field of tuberculosis. I am, however, much interested in watching the development of activity looking toward the prevention of venereal diseases. In reply to Dr. Sollmann's suggestion, I may say that as far as my recollection serves me, comparatively little relation has been found between tuberculosis and venereal diseases from a strictly pathologic standpoint. The subject might develop interesting results on investigation.

DR. ELNORA C. FOLKMAR, Washington, D. C.: It seems to me that in dealing with this problem at present from the educational side we must aim to reach certain classes or groups. First of all, we must reach the parents of the coming generation and we must, as far as possible, reach the coming generation. Many parents are not fitted to teach the young concerning sex hygiene and have no time to prepare for the work. We must, therefore, get at the young people themselves. Another group of persons we must reach is the class of employers. We must demonstrate to them the amount of inefficiency that results from venereal disease. When we touch an economic problem we get support which will help us to carry education all along the line.

In the work in Washington, which was undertaken last year under the auspices of the Woman's Clinic and the Committee on Public Health Education Among Women of the American Medical Association, we did not attempt to press the subject home to any group. We announced that we were ready to give talks on sex hygiene whenever they were called for. One request was made, then another and another until at the end of the year, the last month of our educational campaign, which covered other subjects than sex hygiene, almost all the requests were for lectures on sex hygiene. The requests came from mothers and teachers who are intensely interested in the problem "What will become of our sons and daughters?"

DR. ROBERT N. WILLSON, Philadelphia: I omitted an extended discussion of clandestine prostitution from my paper, since it is too large a subject. It is an important field and the largest number of venereal infections probably spring from it. Its consideration does not properly form a branch of public hygiene and is rather a social problem, one of education and sociology, and especially a question of home surroundings and home management. Whether we will ever handle it properly is a matter for Providence to decide. The clandestine prostitute is more dangerous even than the professed public woman, though there is no prostitute more than a few weeks at her trade without infection from one or both of the two social diseases. I think the method suggested of telling our young people, as in the Navy, that there is a possible prophylaxis,

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would be most unfortunate. I think it is morally unwise, unnecessary and an invitation in the wrong direction. Moreover there is no certain preventive.

I do not think you can frighten any boy into being moral or clean. In the University of Pennsylvania medical department we find the highest percentage of students who suffer from the social diseases; the next highest is obtained in the dental school, and the next in the veterinary. There is always a percentage of infections among practicing physicians; how high nobody knows. Education will not therefore do all. I believe there is a definite relation between tuberculosis and syphilis. I believe the negro race offers a case in point, syphilis existing there side by side with tuberculosis, and offering a ready soil for its development. I have never seen a negro recover from incipient tuberculosis, and believe the mortality of the two diseases is in the negro race a composite one. Last of all, I wish to say that I believe this is not a hopeless problem. I believe the fact that some of the younger medical men and women have within fifteen years seen the work progress from the stage in which all who undertook it were challenged as seeking advertisement to that in which there are demands received every day for teachers and for sane instruction; this, I believe, is the best augury of final success.

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THE WATER PURIFICATION WORKS OF THE BALTIMORE COUNTY WATER AND ELECTRIC COMPANY

S. T. POWELL
Chemist and Bacteriologist
BALTIMORE

Probably there is no body of professional men that more fully realizes the value of pure drinking-water than does the medical fraternity. The physician can wholly appreciate what pure water-supply means to any community and the part it plays in the prevention of certain infectious diseases. For this reason it is believed that the description of the water purification plant of the Baltimore County Water and Electric Company will be of particular interest as it shows to what extent a privately owned water company has carried its purification work in safeguarding its consumers against disease.

The filtration plant of this company is situated at Avalon, Baltimore County, Md., which is about 9½ miles southwest of Baltimore, and the water filtered is pumped thence to a dozen or more suburban places in the immediate vicinity of the city. The plant is novel in many respects but particularly in that there are both slow sand and mechanical filters which are operated daily under identical conditions. This fact has afforded an opportunity for studying the relative values of the two types of filters, a condition which, so far as is known, exists at no other place in the country, except on an experimental scale.

The unfiltered water is drawn during the greater part of the year from Rockburn Branch, a small spring

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stream in Howard County. This stream, which is only 2 miles in length, flows through a sparsely populated territory and empties finally into the Patapsco River. The water is usually clear and contains but a small amount of suspended matter and color although whenever there are heavy rains it becomes quite turbid, because of surface washings from the steep hills near by. When there is not enough water in this stream to supply the filters the deficiency is taken from an impounding reservoir about one-half mile above the plant. The reservoir water comes partly from springs and partly from infiltration from the Patapsco River through the reservoir banks. The quality of this water, although not seriously polluted, could not in its raw state be considered safe for drinking at all seasons of the year. The raw water runs to the plant and on the slow sand beds by gravity, but is raised to the mechanical filter by a centrifugal pump which is operated by a vertical direct-connected Wagner motor.

The slow sand filters consist of two units, having a combined filter area of approximately one-half acre and a capacity of 1.25 million gallons per day. Each unit is operated independently of the other so that either may be cleaned while the other is in service. The sand beds are 34 inches in depth and rest on 16 inches of crushed stone and gravel. The filters are equipped with the usual regulating devices for maintaining a constant head of water on the sand and a uniform rate of flow through the beds.

For the past two years the cleaning of the beds has been done by the Brooklyn method, which is accomplished by allowing water to flow over the sand while men rake the surface. To facilitate cleaning by this method each unit was divided into sections or channels 4 feet wide across the width of the bed by means of pine boards imbedded in the sand and rising 6 inches above the surface of the bed. The head of water necessary is obtained from unfiltered water on the other slow sand

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unit which is in service. Cleaning the filters by this method has given entire satisfaction and is much cheaper and requires less time than scraping and removing the *Schmutzdecke*.

The filtered water from both units empties into the clear water well and is mixed with the filtered water from the mechanical filters. The average length of time between cleaning of the beds during 1911 was thirty-seven days and sixteen hours. These beds are operated during the whole year excepting when the turbidity of the raw water is greater than 100 parts per million, during which times they are out of service. High turbidities plug the bed so rapidly that it was found that it was not economical to operate the beds at such times. The chemical and bacterial efficiencies from these filters have been excellent as will be seen from the accompanying table.

MECHANICAL FILTERS

There are two mechanical filters each having approximately 200 square feet of filter area and combined filter capacity of 1,025,000 gallons per twenty-four hours. The depth of the sand in these filters is 34 inches and it rests on 8 inches of gravel. The gravel prevents the sand from being washed into the collecting system at the bottom of the beds. The rate of flow through the filters is kept constant by automatic controllers and each unit is equipped with a gauge which registers the height of water on top of the sand and also indicates when the bed is dirty and requires cleaning. The filters are washed with filtered water under a pressure of 20 pounds per square inch and the sand is agitated by compressed air under 3 pounds' pressure. In connection with the filters there is a sedimentation basin holding 160,000 gallons, or about four hours' supply for the filters. The alum which is used in this process of filtration is applied to the water in the form of a solution as the water enters the sedimentation basin. As it requires four hours to pass through here, there is ample time for the

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alum to unite with the alkaline salts in the water, which is necessary to form the coagulant, and sufficient time for sedimentation. The treated water from the basin flows directly on the filter beds where the final purification takes place.

Hypochlorite of lime is used on these filters and is applied to the water as it passes from the basin just before the water reaches the filters. The bleaching powder is fed to the water in a 0.5 per cent. solution, through a graduated orifice which is calibrated to read in grains of bleach per gallon of water filtered. The amount used varies from 0.04 to 0.1 gr. per gallon of water or from 0.2 to 0.6 parts per million of available chlorin. Hypochlorite of lime is used, not because the filters have failed to produce adequate bacterial purification, but because it was found by actual operating tests that it was much more economical in the operation of the plant. By the use of hypochlorite it was possible to reduce the amount of alum necessary to obtain high bacterial efficiencies, which thereby increased the length of runs between cleaning the filters and reduced the quantity of water necessary to clean the beds.

The length of time between cleaning the beds varies from ten to forty hours directly according to the amount of suspended matter in the unfiltered water. The alum applied to the water is regulated according to the turbidity present and like the hypochlorite of lime solution is fed through a graduated orifice calibrated to read in grains per gallon of water filtered.

In the mechanical filter-house is a sample pump which is operated constantly and delivers water from each filter unit as well as the raw and treated water so that samples of water for analytical purposes may be taken at any time.

The company maintains its own laboratory for chemical and bacteriologic analysis of the water. The laboratory has many novel features the chief of which, per-

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haps, is the electrical operation of practically all the apparatus used, much of which was especially designed for the particular need of the work at hand.

Samples of the unfiltered and filtered water are analyzed many times each day for a thorough knowledge of the water so as to maintain the filters at their highest degree of efficiency.

TABLE SHOWING AVERAGE RESULTS OF THE CHEMICAL ANALYSES OF THE RAW AND FILTERED WATER OF THE BALTIMORE COUNTY WATER AND ELECTRIC COMPANY

	Unfiltered Water	Filtered Water	
		Mechanical	Slow Sand
Color	28.0	0.0	3.5
Odor	None	None	None
Alkalinity	23.0	17.0	24.0
Turbidity	65.0	0.0	1.0
Total residue at 230 F.	100.0	65.0	66.0
Volatile residue	35.0	17.0	21.0
Ignited residue	65.0	48.0	45.0
Chlorin	3.90	3.95	3.90
Nitrogen as free ammonia	0.0620	0.0240	0.0150
Nitrogen as albuminoid ammonia	0.1883	0.0640	0.0470
Nitrogen as nitrates	0.4170	0.4300	0.4700
Nitrogen as nitrites	0.0030	0.0008	0.0007
Sulphates calculated as SO—			
Required oxygen	2.71	0.75	0.78
Dissolved oxygen—			
Iron	1.24	0.32	0.31
Carbon dioxid (CO)	3.0	4.00	3.0
Hardness	35.60	37.92	35.89

The chemical and bacteriologic work is all done according to the standard method of water analysis compiled by the American Public Health Association. The routine culture medium for determining the number of bacteria per cubic centimeter is nutrient gelatin and the plates are incubated at 20 C. For special work agar-agar and Endo's medium are frequently used.

Owing to the great number of *Bacillus coli* determinations that are made, these are only presumptive tests; but the determinations are made according to the standard methods. Such tests I believe to be quite as valuable for routine work in testing the efficiencies of filters as the more lengthy determinations. All *B. coli* samples are incubated at 40 C., which temperature has a

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tendency to eliminate all bacteria other than organisms that are capable of growing under these conditions.

The accompanying table gives the results of the average chemical analyses of the unfiltered and filtered water during the past four years.

It has been impossible to compile with any degree of accuracy the mortality or morbidity rates from typhoid fever among users of this water. The reason for this is that many of the consumers conduct business in Baltimore where the water-supply is unfiltered, and many have private shallow well-supplies which they persist in using, although a recent investigation undertaken by the company showed that 90 per cent. of these well-supplies are seriously polluted. As far as is known, not a single case of typhoid fever has ever been traced to the use of this supply.

CONCLUSION

It will be seen from the table given herein that both systems of filters have produced high bacterial efficiencies, and the results in general have been quite uniform irrespective of the great fluctuation in the quality of the raw water. Careful interpretation of these results shows that either method when properly operated is capable of producing safe drinking-water, but it depends on local conditions as to which installation will be more economical. The cost of filtration by the slow sand method at Avalon is $8.85, and by the mechanical $9.16 per million gallons. These figures represent interest on investment, depreciation, operation and operating management. These comparative costs cannot be taken entirely as a criterion as it must be remembered that there is no sedimentation basin in connection with the slow sand plant, and that the filters are cut out of service when the turbidity of the raw water is above 100 parts per million.

ABSTRACT OF DISCUSSION

Dr. C. Hampson Jones, Baltimore: The outskirts of Baltimore, a large territory, are covered by neither one of the two water-supply plants, and while nothing can be shown con-

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cerning typhoid fever yet the bacteriologic result will certainly warrant one in believing that any typhoid infection that might be in the raw water has been effectually removed.

Mr. A. H. Wehr, Baltimore: We have endeavored to ascertain the number of typhoid cases in our area, but we do not have a local health department as efficiently conducted as is that in our city under Dr. Jones' direction, and we have to rely, to a very large extent, on the general information which the state board of health has; further than that, there are a great many people in our immediate territory who still rely on their local wells; some of them are some little distance removed from the public water-supply, because it is a suburban or rural community. For that reason we cannot take the returns and apply them directly to our conditions, but I think the typhoid situation in the suburbs of Baltimore is in very good condition. I do know that, in towns in our territory which previously had to depend on local water-supplies and have had typhoid epidemics, since the introduction of our public supply they have had no such epidemics, so that all we can say is, that so long as there is no typhoid, we can at least take unto ourselves a certain amount of credit for eliminating it.

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MEDICAL SOCIOLOGY IN CIVIC BETTERMENT

OTTO P. GEIER, M.D.
CINCINNATI

About six months ago at a meeting of the National Municipal League at Richmond, Va., I heard an interesting paper on "Economy and Efficiency in Health Administration" by S. M. Gunn, professor of sanitary biology and public health at the Massachusetts Institute of Technology. Professor Gunn rather severely and perhaps justly criticized medical health officers of the present day and then proceeded to prove that trained sanitarians should hold these positions. He said:

> Apparent economy may be attained by an untrained man, but in most cases true economy, combined with efficiency, cannot be had unless the health administration is in the hands of an individual thoroughly trained in the sanitary arts . . . It cannot be expected that any one who has not received special training, or who has had merely the few hours of hygiene allotted to the subject in a medical school curriculum, is the proper person to be put in charge of the public health activities of a community. The first essential for any city which is honestly seeking to maintain a health department of real value is to secure the services of a trained sanitarian. There is no alternative in this matter.

In concluding, Professor Gunn stated that if health departments are to be economical and efficient, we must free them from politics with its accompanying uncertainties and strife.

In the discussion which followed, M. N. Baker, editor of the *Engineering News,* further read the death warrant of the medical health officer when he said:

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The question is how and where to get trained men for the work. The training of even the best medical schools is not in the direction of public health work. . . . We are not, however, so badly off as might be thought, because some of our best technical schools, through their courses in sanitary engineering and in sanitary biology and chemistry, are turning out men who are much better qualified to take up the work of the health officer than are those who are the graduates of medical schools . . . Already a number of cities are employing engineers as health officers . . . When doctors are employed, we find either a poor weakling of the medical profession, who has been given his office out of pity or political favor, or else an ambitious young man who is taking up the work while trying to build up a medical reputation.

I have quoted the above arguments at some length because of their authoritative source and because it so aptly illustrates a tendency of the times which is not only to belittle the past attainments of medical men as health officers, but also to discount their ability to handle the problems of to-day and the future. I challenge these statements. These biologists and engineers have apparently forgotten that the tremendous advances in sanitation and hygiene of the past decade have come with physicians generally in charge of all health work; that this progress has been made in spite of the fact that politics has more or less pervaded all health administrations. They themselves assert that even the sanitary engineer can succeed only when the department is freed of politics. Have they not also forgotten, among other things, that it is a physician who has made possible the greatest engineering feat of history, the digging of the Panama Canal, after French engineers had failed because of their lack of knowledge of sanitary laws?

That the municipality to-day needs the services of a sanitary engineer is not to be denied. It also needs food inspectors, chemists, bacteriologists and veterinarians; but to obtain the best results from all these the municipality needs a highly qualified physician in charge, to direct and coordinate their work. The question is not one of the ability of a medical health officer to handle

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the work, but rather the failure of communities to recognize the importance and the necessity of putting the best available physician at the head of it and giving him sufficient power to follow his ideals. Has not the fact also been overlooked in the discussion of this subject by the biologist and engineer, that it is the medical profession which has created the field of the sanitary engineer?

The sanitary engineer demands good pay, and in criticizing health officers as a class, forgets that thousands of medical health officers have been serving without pay or for some pitiful sum in the great bulk of the lesser communities. Has not this unselfish work been the very inspiration, the energizing force in communities which has finally stirred them to an appreciation of the value of preventive health measures? There is hardly a city of any size in which the physicians have not led some movement for health betterment and by such movements educated the public and eventually forced city officials to improve health administration.

HEALTH PROPAGANDA IN CINCINNATI

Cincinnati can be quoted as perhaps the most notable example of such evolution as regards her health department. All the governmental functions of our city had been in the grip of an almost invincible political organization, the Cox ring, for nearly two decades. So compact was their organization, so complete their control, that it held in terror not only the public service corporations but our so-called "best citizens." This organization, of course, controlled the health department and usually selected a fairly well-known physician as health officer and thus placated the public. The organization controlled all the appointments under him. The medical officer accepted the seemingly inevitable and did the best he could under the circumstances.

Cities are said to gain little from spasmodic reform, but let us see how the medical profession of Cincinnati

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made use of their one opportunity. In 1905 the Cox ring was defeated and the newly elected mayor selected as health officer Dr. S. E. Allen, a man of no experience in health affairs, a specialist, in fact, but a man above all things honest, fearless and with a broad social outlook. He appointed equally fearless men as his chief meat inspector and chief milk inspector. In attempting to carry on their initial inspections these men met with all sorts of obstacles, to say nothing of attempted bribery. The published annual reports of their predecessors had stated that everything was in fine condition, and yet Cincinnati was experiencing the second highest death-rate from tuberculosis in the country and its infant mortality was frightful. Now Cincinnati began to know the truth about her dairies and slaughter-houses. The findings of the inspectors were amazing and our new health officer began to visit the dairies himself. Federal officers stated that our dairies were indescribably filthy and "the worst in the country."

The practice of feeding wet distillery waste to cows had become universal and had produced a low type of city dairy. The health officer, recognizing that this style of slop feeding was responsible for the low standards of the dairymen, attempted to stop the practice by legislative action of council. The distillers with their tremendous influence and big fortunes, by injunctions and otherwise, temporarily delayed progress and so this efficient health officer sought other means of helping the situation. A medical milk commission was organized in May, 1906, by the county medical society and fortunately so, for it was this body which continued the fight for clean milk when on the following December our courageous health officer lost his position through the return to power of the Cox organization. Now we could hope for nothing locally, and so the next month a bill was introduced in the state legislature forbidding the sale of milk from cows fed on distillery waste. By this time the milk commission had introduced the pro-

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duction and sale of certified milk, and through publicity had gained the public's confidence. For the next three months a terrific battle was waged between the medical milk commission, fortified by the valiant ex-health officer on one side, and the distillers on the other. The distillers' efforts were strengthened by the former milk inspector, who had now regained his position. It was a battle royal, not confined to Cincinnati, but carried to the state capitol. The milk commission desired the endorsements of the several civic organizations and secured them too, but not until the controversy threatened with disruption the most powerful of these organizations, in which the whisky interests represented over one-tenth the membership and perhaps one-half the moneyed interest. Yet, although the directors of this club were threatened with wholesale resignations if they endorsed the pure milk bill, they stood their ground. When the bill finally became a state law, the Cox board of health refused to enforce it. The milk commission now began legal prosecutions under the law and waged such a forceful campaign for a new and non-partisan board of health that the Cox organization realized the futility of further antagonizing public sentiment. In August, 1909, the council organized a board of health along ideal lines, with the terms of the members so overlapping that a definitely constructive and continuous policy has been possible ever since. We now feel that the great difficulties encountered at the outset have proved our greatest blessing in that every good citizen became acquainted with the real issue during the long-drawn-out fight. A definite public sentiment was crystallized in favor of clean health administration which will resist the attempts of any political organization ever to interfere with our health department affairs.

Our health officer and his force now, for the first time in our history, give full time to the service, and Cincinnati is rapidly reaching a place where its department of health will court comparison with the best in the

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country. This detailed recital is made to show that a few determined physicians can withstand the strongest political organization even when it is allied with "big business," and thereby accomplish much for the cause of good government as well. When the Cox machine was overwhelmingly beaten in the mayoralty campaign last fall, it was freely stated that the health department fight had contributed not a little to the organization's disruption, in that it had made new lines of cleavage in political ranks heretofore absolutely solid. It was probably more than coincidence that our new mayor, Henry T. Hunt, was the very representative in the state legislature who had brought to a successful issue the fight for the pure milk bill several years before.

Now let me add that it was not a "trained sanitarian" who started the revolution in Cincinnati health affairs, but just a plain medical man with a professional sense of duty, coupled with a broad social point of view. Cincinnati's experience can be duplicated in any other city if the medical men will fearlessly oppose the injection of politics into health affairs.

Another interesting fact in connection with this campaign is that city administrations are now very generous to the health department. In 1911 the health department secured an increased budget of 8.2 per cent. over that of 1910, and in 1912 an increase of 13.2 per cent. over 194. Let us see whether this struggle was worth while.

INCREASE IN EFFICIENCY OF CINCINNATI HEALTH DEPARTMENT

	1910	1911
Expenditure	$72,401.51	$78,902.19
Dairies under inspection	about 350	3,500
Dairies in Class A	1	58%
Average bacteria per c.c.	5,700,000	770,000

Decrease in mortality in infants under 2 years of age from diarrheal diseases in 1911 over 1910, 28.6 per cent. (109 infants).

The first inspection in 1911 of the plants of wholesale milk-dealers showed the following:

Equipment, 12.9 Methods, 18.6 Total score, 31.5

The last inspection showed:

Equipment, 23.9 Methods, 36.6 Total score, 60.5

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The first inspection of retail milk-dealers in 1911 showed:

Equipment, 17.6 Methods, 26.4 Total score, 44

The last inspection showed:

Equipment, 29.1 Methods, 38.3 Total score, 67.6

SUMMARY

	1910	1911
Dairy inspections	1,636	5,863
Milk depot inspections	79	815
Store inspections	244	9,150
Total	1,959	15,838

Increased efficiency of milk inspection 707 per cent. over 1910; increased cost, 7 per cent.

MEAT INSPECTION

	1910, Part Time Force	1911, Full Time Force
Veterinarian in charge	1	1
Butchers	7	0
Veterinarians	0	7
Value condemnations	$3,248.50	$9,564.00
Other foods condemned	3,747.20	28,018.55

LABORATORY

	1910	1911
Medical examinations	3,785	4,227
Chemical milk examinations	3,679	8,256
Bacteriologic milk examinations	70	1,487
Cream and ice cream examinations	0	65
Water examinations	27	214
Miscellaneous foods and special analyses	0	108
Total examinations	7,651	14,357

PREPARATION FOR THE OWEN BILL

The active campaign in Cincinnati for a non-partisan board of health drew the attention of the citizens to the value of effective health administration. You may believe that our representatives in Congress will be found supporting the Owen bill. Our congressmen know the public's attitude in Cincinnati and they will show no fear or favor when the bill is at issue. Were such preliminary local effort and accomplishment more general there would not be the situation that now exists in Washington. In their efforts to pass the Owen bill the profession is being forced to overcome the protestations of a horde of moneyed lobbyists, agents of greedy "big business" whose sale of impure foods or drugs may

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be threatened. They must also overcome the influence of those parasites of the poor unfortunate and sick — the patent medicine fakers. These pirates are viciously but adroitly aligned and befronted with that misleading and misbranded organization, the League for Medical Freedom. When the American people come to recognize the evil of decentralization of health control, when they understand the high purposes of a federal board of health, they will demand that they be protected by such a board. Unfortunately for the movement, the public does not understand how unnecessary was the terrible loss of life and property in San Francisco in 1900 and in New Orleans in 1905. Political control of health administrations, coupled with stupid business, cost thousands of lives and millions of dollars following uncontrolled epidemics of plague and yellow fever. We need the federal board to perfect local health administration; we need it to bring about intercity and interstate cooperation and coordination. If you desire then to engage in a national health propaganda, begin your education in your own home towns.

MEDICAL WORK AND SOCIAL SERVICE

Public health and charity work are closely allied. I believe the statement will go unchallenged that an intelligent physician, by previous training and service, is best qualified to consider social service endeavor from the broadest point of view, yet comparatively few are found in the ranks of the social workers who are to-day attempting to solve the many difficult problems that have arisen in congested cities. As a partial recognition of the foregoing fact, a new committee has been appointed which will make its report at the National Conference of Charities and Corrections in Cleveland in June. This committee reports on "The Relation of Medical and Social Work," and in its seven subcommittees will consider this interrelationship under the following topics: hospital social service; visiting nursing; industrial

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diseases and accidents; infant mortality; blindness; insanity and epilepsy; tuberculosis, syphilis, hookworm and alcoholism; sex hygiene, including subject of sterilization.

The wide field of social betterment, with its medical, hygienic and economic background, is one that is familiar to the physician and rather difficult of comprehension by the lay social worker; and yet by a strange transposition of interest and affairs the lay mind, instead of the medical mind, is grappling with these problems. The same criticism might be applied to a large part of the social worker's program.

As further evidence of this I submit to you a few excerpts from a recently published statement by Sara E. Parsons of the Massachusetts General Hospital, an expert in the social service field, in which she attempts to outline for college women the necessary preparation for social work.

She first suggests that the college graduate, as a preliminary, become a graduate nurse, or, as an alternative, on the assumption that this graduate from a girls' college has studied anatomy, physiology, hygiene, bacteriology and chemistry, she ventures to outline a program in preparation for social work as follows:

Actual nursing	2 months
Obstetrics, infant-feeding, etc.	2 months
Child-nursing	2 months
Dispensary work, eye, ear, nose and throat	2 months
Dispensary work, tuberculosis, home visits	2 months
Dispensary work, nerve clinic	2 months
Field work	2 months

This involves a program of eighteen months of study, to which she would add one year in the theory of social service, all of which totals two years and a half of study.

Does not all this suggest that the profession is failing to cover a field of activity which is properly its own? Does it not indicate that the medical colleges should meet this demand of the new social order of things and supply the fraction which is lacking to make of their graduates social workers as well as physicians? Even if

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comparatively few entered the field, would it not so broaden the social outlook of the graduate as to make of him a better physician? The mere insertion of such a course, premedical or elective, would help materially in supplying the great demand of to-day for competent social service workers. There is even greater demand to-day for competent physicians, with a decent social outlook, to take administrative positions in charitable and social service work — the large offset to the ever-narrowing field of the physician resulting from preventive medicine. A few medical colleges have seen the need for a postgraduate course in preventive medicine, and in the near future we can hope to have a supply of trained men for health department work.

COOPERATIVE MEDICAL TEACHING

The Medical College of the University of Cincinnati has recognized the trend of public affairs and is better preparing its graduates to solve the problems of sanitation and hygiene in their respective communities. This university has established a cooperative course in preventive medicine by placing its students directly in the field of health department activity. In his junior year the student divides his time between active service in the board of health work and the regular work of the medical college. The groups of students are assigned to the health department to do chemical and bacteriologic work, examinations of milk, water, and testing for typhoid, tuberculosis and diphtheria. To this are added food, dairy and bakery inspections as well as school inspections and fumigation. In fact, every activity of the board of health is taken part in.

This cooperative plan of teaching hygiene and sanitation in the University of Cincinnati has proved valuable to the students as well as to the health department. It has stimulated better work on the part of the inspectors. The student becomes more interested in his work as he realizes the relative importance of facts and conditions

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observed. Thus the graduates of this college will come to realize the practical importance of municipal health work. They will be more useful advisers to the smaller communities in which they enter practice and will be most helpful in creating a spirit of cooperation between the medical profession and the medical health officer. As a result, greater progress will be made in preventive medicine and public health.

PRODUCT OF PUBLIC INSTITUTIONS

The physician enjoys the most direct approach to the public and it is his duty to crystallize a public sentiment that will be appreciative of the tremendous advantages of hygienic living. It is also his duty to lead the way in insisting that public institutions be conducted in a humane and intelligent manner. In viewing the problems of the city's dependents he readily supplies the scientific background. He should know of the neglect that is usual in the care of indigent adults in almshouses. He should appreciate the menace of the feeble-minded outside the confines of an institution. He recognizes some of the causes, at least, of insanity and could be helpful therefore in its prevention. He should be the court of last resort to determine the admission or non-admission of the sick and afflicted to institutions, and lastly, he should be best qualified to judge wisely the problems involved in child welfare work.

INDUSTRIAL HYGIENE AND THE PHYSICIAN

Leaving the field of public charity and institutional work, there is the almost undiscovered one of improving the industrial life and activities of the wage-earner. It remains for the physician to prove to the capitalist that shop sanitation is a factor in industrial efficiency and that it pays fully as well to conserve the health of the human operator, as it does to reduce the number of lost motions by "scientific management."

The capitalist must be shown (1) that industrial hygiene induces a better personal hygiene, which in turn

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energizes the employee; (2) that efficiency of mind is affected by home and shop conditions; (3) that its ultimate result will be to keep busy many a machine now idle because of the preventable illness of the employees manning these machines; (4) that a better appreciation of the value of good health for itself will alone raise the standard of efficiency of any workman; (5) that improved personal cleanliness and better health make for a greater self-respect in any individual and tend to improve his family relations; (6) that betterment of civic health makes for happier homes, and healthy and happy homes are fundamental structures on which the commercial advancement of any city must largely be built.

In business life the brains and the energy of the American have astounded the world. The more intelligent captains of industry are now busily at work helping to improve industrial conditions, and are thereby solving some of the social problems. In many factories social service departments are being instituted in charge of physicians. The machine-tool industry in Cincinnati was influential in having the board of education take over the continuation schools previously conducted by them in their plants and permanently incorporate them as a part of the school system. This same group of men also saw the wisdom of cooperating with the dean of the engineering department of the University of Cincinnati when he proposed to establish the first cooperative course of engineering, in which the student spends one week in the university and the next week in the shops. Besides increasing the efficiency of the graduate, this plan has a social phase in that it enables the student to earn his living while getting his education.

THE MEDICAL MAN IN THE NEW SOCIAL ORDER

The physician to-day does not occupy the exalted position that I would covet for him, partially because of a false sense of professional etiquette which has kept him from taking an active part in political affairs. The

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physician whom the public has generally seen in public positions is the "political doctor"— a man of no high standards, moral or professional — and this man has substituted in the minds of the people his standards for those more ideal ones of the profession.

The criticism that I direct at the medical profession is born of the hope that the members of the profession may be awakened to a sense of their real power, their great influence, their moral obligation and their greatest opportunity, that of serving all the people. They must align themselves with the modern idea of community life: "the whole for every man, and every man for the whole."

The appeal is likewise born of the belief that this, the noblest profession, in so widening its scope, is serving itself best; in so doing it is coming back into its own heritage, that of enjoying the respect, the admiration and the unbounded confidence of the American people, without which we must fail in accomplishing our highest mission.

This democracy of ours offers to us possibilities for growth and extension of propaganda not enjoyed by the physicians abroad, where the profession and health officials are bound about by tradition, official life and red tape unknown to us. Our opportunities for progress are greater, our responsibilities and obligations are likewise the greater.

The medical profession, scientifically, is rapidly placing itself on a par with the profession of the older countries. We have the knowledge to take up the tasks of preventive medicine and sociology in this country, and the opportunity is ours. If we but supply the necessary interest and energy, public welfare work in its broadest and truest scope will go forward by leaps and bounds. There will grow alongside of it and directly out of it a higher sense of public duty, a more ideal and unselfish citizenship — a citizenship that will more fully realize its deep obligation to the medical profession; and in this

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mutuality of confidence and regard, the medical profession will take a new and higher place in the community and will receive rewards not yet dreamed of.

Physician, "know thyself" — know thy strength, thy power, thy scope; physician, "heal thyself" of a contracted vision as to thy field of usefulness. From the ranks of thy profession must be developed the true "social engineer" to lead in the present world movement for social improvement. This social engineer will find his life — the extension of the humanities; his hope — the prevention of life waste; his work — service to mankind.

1609 East McMillan Street.

ABSTRACT OF DISCUSSION

DR. C. HAMPSON JONES, Baltimore: I have voiced these views for some time, in a very limited sphere. In our annual report, I have insisted that the commissioners of health must largely become sociologists. That is particularly true in obtaining death-rates and the cause of death-rates, obtaining the birth-rates and the cause of the low birth-rates, the study of infant mortality, and so on, by taking special census of the cities into which you go; but you can inject the social workers directly connected with the health department, or members of independent organizations that can and will work in harmony with the health department.

DR. M. P. RAVENEL, Madison, Wis.: I would be the last man to belittle the service of trained sanitary engineers. When they take the stand, however, that they are the only people who know how to run departments of health, they are like a man looking through a microscope, seeing one small field very much enlarged and losing sight of the rest of the specimen. There have been a few sanitary engineers who have made good health officers. I believe that without exception they have been in small cities. The splendid conduct of health matters we find in the state of Indiana is all due to a physician; the cities of Chicago, Detroit and Philadelphia were brought to the highest efficiency in health matters by physicians. I cannot think of any city or state in this country which has made any great advance that has not been under a physician as health officer. When you come down to the bottom, medicine is the foundation of all biologic and social training. What Dr. Geier says is exactly right, namely, the medical schools must keep up with the times; they must branch out a little. Everybody should read the

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brochure of Dr. Norman E. Dittman entitled "Education and Preventive Medicine," noticing especially the outline at the end of the book which he has given for a course in preventive medicine. At the University of Wisconsin, for several years past, Professor Ross has been advising his students to take medical bacteriology, in which course they get a good training in contagious and infectious diseases. Every social worker should have training in this sort of medicine.

While it is true that not many places are open at the present time for graduates in preventive medicine, they are increasing at a tremendous rate. We expect to graduate our first student with the degree of Doctor of Public Health this month, and already a place is waiting for him. We must educate the people to the necessity and value of preventive medicine, proving to them that it is the cheapest and best life insurance in which they can invest. As soon as business men realize this fact we will find all cities employing thoroughly trained health officers.

Dr. J. N. Hurty, Indianapolis: Only the other day I happened on one of the works of Descartes. You know that Descartes was probably the most original mind of this later age; and certainly, he, more than any other thinker, has influenced modern speculative and experimental thought. He said that if ever the human race (he was not a physician) is to be raised to the highest practicable level, morally, mentally and physically, medicine would point the way. This, which was said over two hundred and fifty years ago, struck me as a very forcible and wonderful utterance. It is through hygiene that the human race is to be raised; it is hygiene that will finally purge the human race, as far as is practicable, of the terrible social diseases and of all of the other diseases which drag us down and which cost us so terribly. It seems to me there is no question about it.

Instead of believing that there is an oversupply of doctors of public health, I have decidedly the opposite opinion. We want this minute ninety-two doctors of public health in Indiana, for commissioners of public health in each of our counties. There is indeed a good market for them. At the University of Michigan, not long ago, I studied the requirements for the degree of Doctor of Public Health; I think that they are too high at the present time. They are ideal. We should aim at the ideal, but we cannot reach it all at once. I do not believe the universities will turn out enough doctors of public health to supply the Indiana demand for a long time, and I hope that the standard will not be placed so high that we may get a larger supply within a reasonable time. We cannot reach the ideal at one step.

Dr. Otto P. Geier, Cincinnati: I hardly can emphasize any more definitely than I have the points at issue. The physician is forever turning aside the opportunities that are

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presenting themselves to him in the social service field. We might well consider the economic phase of this question from the medical standpoint. We are reducing incomes in the profession 30 to 40 per cent. by medical preventive work, and we should plan to take care of the physician who has cooperated in reducing his work and thereby his income.

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THE NECESSITY FOR RODENT EXTERMINATION IN AMERICAN SEAPORTS

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The rodent is the twentieth-century anachronism. He is as archaic as the neolithic midden with which he is coeval, and yet to-day we tolerate him, permit him to devastate our storehouses and to act as the intermediary vehicle for the transference of the organisms of disease between his loathsome carcass and the body of man. The toleration which we have shown for this inhabitant of the sewer and frequenter of the dump is perhaps due to the fact that man is by nature a lazy animal and will make no unnecessary effort unless spurred to it by some circumstance in his environment. It has been necessary for plague to ravage the world many times before man has learned well the lesson that the rat and his confrères, the mouse and the ground-squirrel, are among the most deadly animals with which he has to deal.

That rats are the carriers of plague is too well known to merit more than a passing reference here. They are also afflicted with a leprosy-like disease which closely resembles, both in its etiologic factor and in its pathology, the leprosy of man. A number of other diseases exist commonly among them, the organisms of which are believed to be capable of producing human disease. They are also the hosts for a legion of entoparasites, while ectoparasites, such as fleas, lice and ticks, infest their hairy bodies. Furthermore, they are afflicted

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with new growths both of the benign and malignant types, and if we were to accept the parasitic theory as to the etiology of the latter, it might be that we would find that the rodent played a rôle in the dissemination of cancer.

The rat, then, is a menace to us physically. He also threatens us commercially. Traveling in the bodies of ships, and dogging the commercial highways of the world, he is the veritable "old man of the sea" whose appearance in the community is the sign of impending pestilence and the resultant commercial disaster. Plague is essentially a disease of commerce and not only does harm through the human sacrifices which it claims, but also because of the great fear it engenders levies a heavy commercial tribute. In addition to the depredations thus produced by this murine enemy, the mere item of subsistence alone is enough to warrant us in attempting the limitation of this species. A rat will consume approximately a bushel of grain in a year. If the cost of this be taken at $1, it can thus be seen that the community suffers an enormous loss in this way. But the depredations of rats are not confined to relatively cheap articles; the choicest fabrics and leathers, books and objects of art — none of these is spared; poultry and eggs, seeds and bulbs — all are destroyed by these vermin; and still the indictment against the rat is not complete unless we mention the many disastrous fires which have been caused by the rats' fondness for phosphorus which leads them to gnaw matches which have been carried to their nests. These are composed of dry and very inflammable material and are usually hidden in some secret labyrinth between floors and walls, and the fire reaches unquenchable proportions before its discovery. We must add to the charge of arson that of theft, for there are numerous instances on record in which rodents have carried away, for pure wantonness, jewelry and other articles of considerable value.

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Aside from the extensive work which has been carried on in California, no effort of any magnitude has been made to check the inroads of these vermin or to determine whether or not they are infected with plague or some other disease which is pathogenic for man. It is a well-known fact that plague may smolder in a rodent community for a considerable time before accident brings about a closer contact between infected animals and man, thus giving rise to an epidemic. The effort of the sanitarian should be to discover the epizootic foci of the disease and to eradicate them before the opportunity for the transference of the disease to man occurs. It is equally important that the importation of rats, particularly infected rats, into a clean community, or the exportation of rats from a plague focus, be prevented.

The prerequisite to this is the trapping of rats, and it is the duty of every maritime city in this country to begin a sanitary survey of its rodent population. The methods for the trapping and examination of rats have been thoroughly discussed elsewhere[1] and it will be sufficient to indicate here that trapping, to be of value, should be systematic, that captured rodents should be carefully labeled, and that they should be examined by a competent bacteriologist. An accurate record of every rodent taken should be kept and the data obtained by such a survey should be intelligently tabulated. This is important for many reasons, not the least of which is the value of a record of the rat catch on premises on which it is desired to force sanitary improvements. No property owner was ever known to admit the presence of rodents on his premises, but confrontation with the register of the rats taken on his holdings is an unanswerable argument. Moreover, this is the preliminary step toward the securing of adequate ordinances bearing on the proper disposal of garbage and other

1. The Rat and Its Relation to the Public Health, Pub. Health Bull. 30, U. S. Public Health and Marine-Hospital Service, Washington, Government Printing Office, 1910.

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wastes, the sanitary construction of stables and chicken-yards, the regulation of places in which foods are prepared, stored or sold, and the rat-proofing of buildings used for human occupation. It will thus be seen that the sanitary surveillance of the rodent population is the starting-point of a series of sanitary reforms which have a vital bearing on the public health. This is important, not only because of the security from plague secured thereby, but also because the measures which are directed against pest exert a preventive action against many other communicable diseases. Thus, it was observed that the plague-eradicative work in California was accompanied by a subsidence not only of plague but also of most of the acute infectious diseases both of man and of domestic animals.

Perhaps the most important single result of the attempt at the limitation of rodent activities is rat-proofing of buildings. This is a form of insurance — insurance against fire and pestilence. It is more than this, it is a plague-eradicative measure of the first magnitude, because it is axiomatic that he who dwelleth rat-free taketh no plague. The ideal agent to be used in this "building the rat out of existence" is concrete. Next to it in value come metal and other substances through which rats cannot pass. It should not be forgotten that the concreting of basements and the erection of area walls benefits the health of the householder by reason of the exclusion of dampness, and the removal of planked-over back yards and their replacement by cement makes for the general cleanliness of the premises. Permanent rat-proofing is therefore not an expense but a permanent health investment paying good dividends.

In this connection should be mentioned screening, because no matter how well the lower levels of a house may be fortified against rats, such efforts are nugatory unless the windows and other openings are screened. This means the exclusion not only of the rat but also

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of the fly and the mosquito, thereby affording protection against the diseases which these insects carry.

When we campaign against the rat, we not only destroy his abiding-place and exclude him from the home of man, but we also endeavor to separate him from his food-supply as well, because the famished rat does not linger. The point of attack is the garbage-can. This probably is the most misused of all the household utensils; hated by the housemaid, bumped and dented by the garbage-man, overturned by hungry cats and dogs, the receptacle for filth, and the begetter of noisome odors, it is at once a most useful and a most dangerous sanitary instrument. If we could ensure that every garbage-tin in a city was water-tight, well covered and maintained in a cleanly condition, we could feel a reasonable security from rats and flies. It is not enough, however, that garbage-cans be tight and clean; the collection and disposal of their contents requires careful supervision. This comprehends a study of the city's entire refuse-disposal system and if necessary its reorganization to meet the sanitary needs.

The stable, furnishing as it does both a harbor and a commissary for the rat, should receive careful attention. In the first place, let it be said that unless they are as carefully regulated and as cleanly administered as a human household, stables have no place in the scheme of the modern city. Thanks to the advent of the automobile and the motor-truck, the day is not far distant when the rat-infested, fly-breeding stable will have been relegated to the age of sanitary darkness. Stables to be rat-free should be rat-proofed by the installation of concrete floors; the manure should be kept in air-tight metal-lined boxes, and the stable itself should be screened and connected with the sewer.

The hungry and homeless rat may be poisoned with ease. This requires relatively little labor and every householder should be encouraged to poison the rats on his premises. Various agents have been employed for

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this purpose, but all things considered, phosphorus seems to be best for the purpose. It may be said in its favor that rats like it, that it is cheap and that it is certain in its action. The fact that it deteriorates on exposure to sunlight is not an unmixed evil, because if poison lies about for a considerable time it may be taken by some animal other than the rat. A very effective formula contains 4 per cent. of phosphorus in a glucose base. Rat-poisoning is a duty too frequently overlooked, and we shall do well to follow the example of our European cousins, and institute rodent extermination campaigns in all our large cities.

We have thus seen into what a varied field of public health activity the efforts at rodent extermination logically lead us. Supposing, that in our examination of the captured rodents we uncover a plague focus, what will be our method of procedure? In the first place we have, so to speak, the "choice of position," which is no mean advantage. We can strike before the epizootic becomes an epidemic and we can strike so quietly and so surely that no disastrous result need come to commerce. In this lies the great argument for rodent exterminative work in cities in which plague is not known at present to exist or in which plague has never been found. Plague has left its spoor at almost every junction of the trails of trade, yet it has not been recognized until it has signalized itself by the occurrence of human cases. Who can doubt that if the rats of the great seaports of the world were examined, the infection would be found in many cities heretofore considered plague-free? And who can controvert the statement that if the infection is recognized now and promptly up-rooted many lives and millions of money can be saved?

The first thing to be done on the discovery of a plague focus is to wipe it out. In order to wipe out a plague focus it is necessary to kill the rats therein. It is impossible by any single known method to accomplish this. Hence, reliance must be placed on a combination of

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methods which will attack the rat along every avenue of his existence. There is more to this than the mere killing off of the rat, because when an attack is made on any species which lives in more or less close proximity to man, there is a coincident improvement in the environment in which man lives, and hence there is a decided falling off of the diseases which are essentially environmental in character. Rats may be killed by starvation, prevention of multiplication, eviction, poisoning, trapping and the employment of natural enemies, such as the dog or the cat. The technic of these methods has been discussed elsewhere, and it need be only mentioned here. The reduction of the rodent population in an infected zone is in reality a question of dilution of the infectable material, and even though the rats which remain have a better opportunity for securing food than they had previously, the fact that they are widely separated from one another causes the disease to die out among them.

Since plague is a disease of commerce, and since plague is a disease of rats, and since rats journey over the world in ships, it is the duty of persons who are charged with the protection of the health of marine ports, to kill rats in ships. This is best done by periodic fumigation, either by sulphur dioxid gas, carbon dioxid, carbon monoxid or funnel gases. This is cheaply and easily done, and if these remedies were periodically applied at all of the ports of the world, it would not be very long before the disease ceased to follow the track charts of marine commerce. In order to secure such action, it would be necessary for the powers of the world to enter into an international sanitary agreement. This would entail considerable labor and expense, but if it were accomplished, it would prove a measure of great good. Couple this with the extermination of rodents in seaports and plague would soon be relegated to the museum of paleolithic sanitation.

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BACILLARY DYSENTERY

A CONTRIBUTION TO THE STUDY OF THE EPIDEMIOLOGY

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Under the direction of Dr. Samuel G. Dixon, commissioner of health of Pennsylvania, I have had an opportunity to study the infections by members of the typhocolon group, and with his permission the results are now presented as a preliminary report.

The bacilli classified in this group of microorganisms possess such great differences in pathogenic characteristics and so many points of similarity in morphology and biology that infections by members of the group often present difficulties in establishing an individual clinical as well as an epidemiologic diagnosis.

It is especially desirable in this paper to discuss, in their epidemiologic relations, infections by members of the group giving rise to dysentery as the chief clinical characteristic, and the relation of outbreaks of dysentery to typhoid fever.

The work of Shiga and all who have since studied the dysentery bacilli has led to the etiologic division of infections by these microorganisms into two forms, bacillary and amebic dysentery; there is reason to add to this classification the form caused by the presence in the intestinal tract of the *Balantidium coli*, namely, balantidic dysentery. The last two forms will not be discussed in this paper.

In Pennsylvania, for the purpose of supervision and control, all forms are required by law to be reported to

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the health authorities under the term "epidemic dysentery." In only seven states and territories, California, Louisiana, New Jersey, Pennsylvania, Texas, Hawaii and Porto Rico, has an attempt been made to control the spread of this disease. The actual reporting and supervision of cases of dysentery except of the amebic type, however, so far as I have received information, is not practiced in any health jurisdiction of America. Under the jurisdiction of Hawaii and under the direction of the federal government in the Panama Canal Zone and the Philippine Islands, amebic dysentery is required to be reported and placed under certain quarantine regulations. In Pennsylvania, since the organization of the State Department of Health in 1905, there have been nine epidemics which were sufficiently large to investigate because the attention of the department was directed to them by reason of the mortality or of the association with typhoid fever, or because of the relation of sewage from the affected district to the public waters of the commonwealth.

Studies of outbreaks of proved water-borne disease in Pennsylvania have demonstrated the prevalence of acute bacillary dysentery and in many instances its relation to typhoid fever.

HISTORICAL

In Johnsonburg, Elk County, with a population of 4,200, during August, 1905, there was an epidemic of dysentery, the extent of which could not be learned (but which was admitted to be very large), about ten days prior to the development of twenty-nine cases of typhoid fever as diagnosed clinically. There was no mortality during the outbreak of dysentery, but five of the typhoid fever patients died, a mortality of 17.2 per cent. The local diagnosis was "dysentery," but apparently it had no significance to the local health authorities. No bacteriologic analyses were made except that the water-supply was shown to be polluted with sewage organisms, the source being evidently from a lumber camp located on

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the banks of one of the streams supplying the borough with water and containing twenty-two men who had suffered with "bowel complaint."

In Warren, Warren County, with a population of about 10,000 at the time, an epidemic of "intestinal disorder" which is shown to have been water-borne, occurred during April, 1906, at which time 406 cases developed, not violent enough in character to require medical attendance. During the same year, between the dates of December 7 and 12, there occurred an estimated number of about 1,800, 600 persons being taken ill during one day, with the local diagnosis of "gastro-enteritis resembling mild ptomain or arsenical poisoning," the general features of which were sudden severe cramps in the abdomen followed by diarrhea, vomiting and great weakness. A few patients had high temperature followed by syncope. The excreta were watery and brownish. The duration of the illness was from three to six hours in the great majority of cases, followed by recovery. Others were more severely ill for thirty-six hours or longer. The laboratory examinations showed the water to be polluted with sewage organisms. The examination of the feces showed the prevailing microorganism to be a Gram-negative rod, apparently a bacterium, with characteristics which were common to *Bacillus aerogenes capsulatus* and hog cholera. It was negative to guinea-pigs. No organism suggestive of typhoid bacillus or cholera vibrio was discovered in water or feces. This outbreak was not followed by any known cases of typhoid fever.

In Kittanning, Armstrong County, with a population of 4,500, there occurred in January, 1907, a sudden and wide-spread outbreak of gastro-intestinal disorder which varied in severity from cases of simple diarrhea to cases presenting the symptom-complex of dysentery. It was shown that transient visitors to the town were particularly susceptible. The general features were sudden onset, accompanied by vomiting, purging and profound

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prostration. Other cases simulated influenza of the so-called abdominal type. In a certain number of cases there was severe rigor followed by temperature of the remittent type, general muscular pains, bronchitis and marked malaise. Many of the cases simulated typhoid fever, but as they improved on or about the tenth day the diagnosis of typhoid fever was not made. The outbreak followed immediately after certain changes in the public water-supply during the first week in December, and December 26, the first one of fifty-one cases of typhoid fever was reported to the local board of health.

At Mount Gretna, Lebanon County, in a military camp, during July, 1909, there was an outbreak of dysentery which was followed within one or two weeks by an unstated number of cases of typhoid fever. It was shown to be a water-borne infection. There was no bacteriologic analysis.

In that portion of Allegheny County in which 18,000 persons are supplied with water by the Ohio Valley Water Company there occurred during January, 1909, a dysenterial disease, the local diagnosis of which was "gastro-enteritis." The prevailing symptoms were abdominal pains followed by vomiting, diarrhea, lassitude and copious and watery excreta, lasting for a period of from three to seven days. An actual census of the cases showed that 2,887 persons, or nearly 16 per cent. of the total population, were ill. Analysis of the public water-supply showed the presence of sewage organisms, and three weeks from the date of onset of the first cases of dysentery there developed sixty-three cases of typhoid fever. The mortality was six, or about 10 per cent.

In Erie, Erie County, with a population of 66,525, there occurred during December, 1910, and January, 1911, two outbreaks, the local name for which was "winter cholera." These followed unusually severe northeast gales on Lake Erie, from which the water for the city supply is taken. The public supply became unusually turbid shortly after December 1 and almost imme-

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diately afterward there was a marked outbreak of acute enteritis appearing in all parts of the city, which by many physicians was called "intestinal grip." Clinically the disease, according to Dr. J. W. Wright, county medical inspector for the State Department of Health,

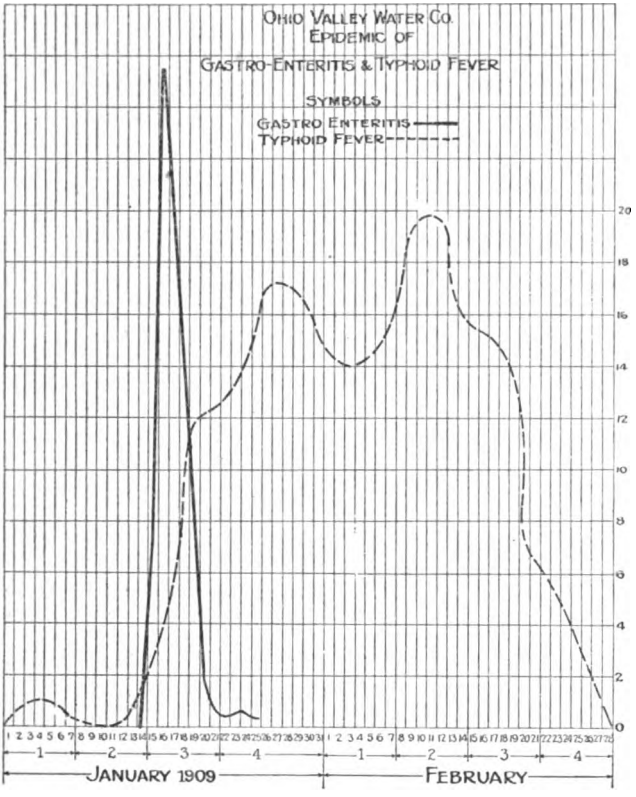

Chart 1.—Curves showing the dates of onsets of 2,887 cases of acute bacillary dysentery followed by sixty-three cases of typhoid fever in municipalities served by the Ohio Valley Water Company. The curves are drawn to different scales.

and city health officer, was as follows: sudden onset with slight constitutional disturbance but characterized by severe abdominal pain, and followed in a few hours by frequent, profuse, watery stools; the discharges were offensive and accompanied by much flatus.

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In the more severe form there was a moderate rise in temperature, all of the symptoms being more aggravated, and in some instances accompanied by intestinal hemorrhages. In mild cases the patients recovered within two or three days but cases of the more severe form lasted from ten days to two weeks and frequently were marked by relapse before complete recovery. Cases presenting these symptoms were first observed about December 10, the acme of the outbreak lasting about three days, on or about December 15. Various estimates have been made as to the total number of cases and it is generally agreed that there were probably 20,000 cases in this one outbreak. Typhoid fever, which had been practically endemic in Erie, immediately increased in the number of reported cases, the height of the outbreak occurring December 25, as indicated by the dates of onset. The number continued relatively great up to Jan. 10, 1911. Following the same storm history and tidal history of the lake waters, during the early part of January there occurred a second outbreak of dysentery of the same type, during which, however, a lesser number, probably 10,000 persons, became ill. Following this outbreak of dysentery there occurred another outbreak of typhoid fever, the height reaching its greatest point about February 1, and slowly subsiding until measures were instituted by the State Department of Health under the direction of Dr. Samuel G. Dixon, as indicated in Chart 2. The sterilization of the water was begun January 28, district nurses began their work February 5, and an emergency hospital was opened February 14. By these measures the occurrence of both primary and secondary cases was rapidly eliminated.

To recapitulate: There occurred in Erie during December, 1910, and January, 1911, an outbreak of dysentery with a conservative estimated number of 30,000 cases, each outbreak being followed within a period of ten days, as indicated by the height of the

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curve of onsets of those cases studied, by a total of 886 cases of typhoid fever and 126 deaths, or a mortality of 14 per cent. The percentage of deaths from the dysentery infection cannot be properly estimated.

In Chester, Delaware County, with a population of 38,537, there occurred during January, 1910, an outbreak of dysentery which was diagnosed locally as being "winter cholera" and was traced to the water-supply of a manufacturing company employing 7,000 wage-earners. The total number of cases has not been correctly estimated but it was shown that the absentees between January 3 and January 25, because of dysentery, ranged from eighty-eight to 265 in a single day. No increase above the normal typhoid fever rate for Chester followed this outbreak. There were no deaths.

Engineers from the State Department of Health discovered and immediately abated the source of the water pollution; a field laboratory was established by direction of the state commissioner of health and thirty-three suspected cultures were isolated from stools of the patients; twenty-nine proved to be *B. coli communis,* various forms of cocci and a few *B. aerogenes.* One of the remaining four was *B. cunuculicida,* closely related to the swine plague group. The other three were found to belong to the colon bacillus group and hog cholera group and most closely resembled *B. poelsii* but differed somewhat in growth on milk and potato. They differed from the hog cholera bacillus in their action on milk and in their indol production, which was, however, very slight. They were called paracolon bacilli because of the sugar reaction and action on milk and slight indol reaction.

The three cultures were isolated from two stools of the sick, one case being well advanced and the other just past the height of the infection. The other cultures did not show any of these colonies, but one acute case, although showing none of these organisms in the stool, gave a positive serum reaction. The biologic character-

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istics noted are found in several of the meat-poisoning group but do not correspond exactly with any of the described forms. The bacterium was isolated from one case just past the height of the condition and one convalescent. It was agglutinated by the serum of one early case but was not agglutinated by the serum of the patients from whose stools it had been isolated. There is no reason to believe that the clinical course of the case giving the agglutinating serum is any different from the courses assumed by the other cases. Other samples of water were incubated and after thirty-six hours were fished for colonies resembling *B. dysenteriæ,* the paracolon bacillus and *Vibrio choleræ.* None were found. Larger numbers of *B. coli,* however, were found in the sediment of the drinking-supply as well as in the sediment of the raw river-supply. The organism recovered corresponds biologically to the bacillus of Poehl, recovered from patients in an epidemic of dysentery in Rotterdam.

During February of 1912, I was assigned to investigate the reported cases of "Asiatic cholera" in Iselin, Indiana County, which is an unorganized community with a population of 2,700. The outbreak was proved to be a water-borne infection, the spring source of which was polluted directly by the excrement of hogs and chickens and a more remote pollution by human excrement. The early cases were marked by an abrupt onset and propulsive, watery evacuation (intestinal hemorrhage occurring in one), with vomiting and abdominal pain. There were a few cases with elevated temperature, the major number having subnormal temperature with marked prostration. The first of these patients was seen on or about February 1, and as only a fraction of the total population obtained water from the infected source and as all who sickened were Polish or Hungarian in nativity, it was not proved, but was apparent, that the earliest cases were of a dysenterial type. Later, after February 10 or 11, fifty-three cases, in part typical cases of typhoid fever, in part simulating typhoid, developed.

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During September of 1911, I was assigned to investigate an outbreak of dysentery in Bethlehem, Lehigh County, which has a population of 12,837. Acting

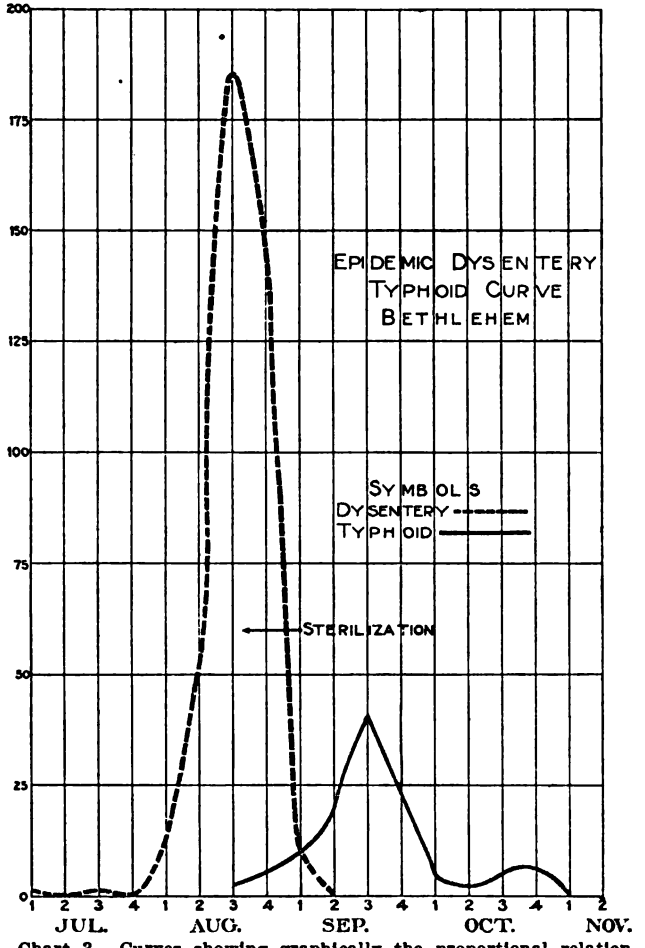

Chart 3.—Curves showing graphically the proportional relationship of 408 cases of acute bacillary dysentery and of eighty-eight cases of typhoid fever occurring in the Bethlehem epidemic. The scale in this chart is the same for both curves. The date of the sterilization of the borough water-supply is indicated.

under the authority of the act of assembly dated May 14, 1909, the physicians were required to report all cases under their care. This is the first time in Pennsylvania

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that dysentery has actually been reported during the course of an epidemic or otherwise.

A total of 408 cases was so reported and studied, though there was indisputable evidence that upward of 1,800 cases existed in the borough between the dates of August 1 and September 6. This outbreak of bacillary dysentery was followed by a total of eighty-eight cases of typhoid fever, the maximum number of cases being reported three weeks from the date of subsidence of the dysentery outbreak. The clinical features of the dysentery were abruptness of onset and the great variation in the course and character of the symptoms, as has been noted in certain previous outbreaks. The source of the infection, except to certain members of the local board of health, was not apparent to the residents of Bethlehem, and many persons ascribed it to temperature and other meteorologic changes.

Bethlehem's water-supply is obtained from springs, and the residents boast of having the second oldest water-works in the United States. The geologic formation is almost entirely limestone and the sewage in this very old community has been for years directed into crevices of the limestone formation. The spring is at the base of the hill and unquestionably receives some portion of the 100,000 gallons of water, plus the sewage which passes into these crevices during every day of the year.

The analysis of the water showed, in addition to the *B. coli communis,* the presence of the *B. alkaligenes, B. suicidus,* the *B. acidi lactici* and a form corresponding to the strain of the dysentery type described by Rosen. The blood of seven known cases of dysentery infection agglutinated the last-named microorganism in dilutions of 1:50, which was the only dilution employed, while reactions with the *B. poelsii,* paracolon bacillus, *B. dysenteriæ* (Shiga) and *B. enteritidis,* (bacillus of Gaertner) were negative when studied in the same dilutions. Blood from the same patients was studied in relation to

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B. typhosus and *B. paratyphosus* A and B, with negative results. The same organism was recovered later from the feces of two of the patients and corresponded in all of its biologic features with the microorganism which was recovered from the water-supply of the borough.

TYPES AND PATHOGENICITY OF ORGANISMS

There is no question as to the relation between organisms of the dysentery group and the diseases classified as acute dysentery. It is obvious, from the work of many investigators, that there are many types of dysentery bacilli and that each type may be the factor in an outbreak or apparently there may be mixed types, as noted by Gay, Duval, Hastings, Shiga, Park, Hiss, Russell, Whitmore and many others. The variations, both in the type of organism and in the clinical phenomena, have until recently made the diagnosis confusing. Recently it has been possible to classify the many strains belonging to this group, which have been isolated and carefully studied, into three distinct varieties of types. The type most frequently found in severe epidemics and the one which probably contributes to the highest mortality is known as Type 1 and includes the Shiga organism and all strains which have similar biochemical properties. Types 2 and 3, as a rule, cause a much milder clinical course; both are biochemically more nearly like strains of the colon group than are members of Type 1.

The bacilli of Type 1 do not produce indol and do not ferment mannite, maltose or saccharose; they produce agglutinins specific for strains of their own type and but little for members of other types. Type 2 ferments mannite with the production of acid reaction but does not split maltose or saccharose in peptone solution or agar; it produces indol and also produces agglutinins specific for strains of its own type. Type 3 is nearest the colon group since it produces indol and actively ferments mannite and maltose but acts feebly on saccharose.

The organism isolated from feces in the Warren epi-

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demic would seem to conform to Type 3 though the identification by cultural and other methods was not carried out in detail. Clinically, the course of the disease in all cases introduced by this microorganism was mild.

The type isolated from feces in the Chester epidemic would also seem to be identified with strains of Type 3 since its characteristics resembled closely the bacillus isolated by Poehl, which can properly be grouped as a paracolon organism. The organism recovered from both feces and water during the Bethlehem epidemic corresponds to Type 2, however, as shown by its biologic characteristics; indol was but feebly and inconstantly produced; dextrose and mannite were fermented with the production of an acid reaction; saccharose was not fermented and there was no gas production. The serums of patients from whom it was isolated and the serums of other patients suffering with the same clinical course agglutinated this organism in dilutions of 1:50 before the end of one hour and failed to agglutinate the *B. dysenteriæ* (Shiga) and the *B. poelsii* (isolated from feces in the Chester epidemic). Studies with immune serums of known strains were not made.

Park suggests restricting the name "dysentery" to infections by the Shiga type and "paradysentery" to all infections by forms which fall into the other two types, giving as reasons their greater similarity to the colon group, as indicated in indol production, greater range of carbohydrate activity, and also the fact that they give rise to a much milder clinical type of reaction. Were this suggestion followed it would be less confusing for the practical purposes of both study and control. The pathogenicity of the types here reported would, then, correspond to the paradysentery type as the course of cases of the major number of epidemics studied was mild, and as a result the mortality was very low; in those instances in which an organism was isolated and identified, it was shown to belong to Types 2 and 3.

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SEASON AND AGE

Infections by Type 1 are said to prevail from early summer (June or July) to the end of October and practically to disappear during the winter months. In contrast, the epidemics studied in Pennsylvania show the following occurrence:

Warren, Warren County	April
Kittanning, Armstrong County	January
Ohio Valley	January
Erie, Erie County	December and January
Chester, Delaware County	January
Iselin, Indiana County	February

The Johnsonburg, Elk County, epidemic, however, occurred during August; the Mount Gretna, Lebanon County, epidemic during July, and the Bethlehem, Northampton County, epidemic during September. It was possible to study the relation of the temperature range and the daily precipitation in relation to the dates of onset of the 408 cases in Bethlehem. This is presented in a graphic way in Chart 3. Since two-thirds of these water-borne epidemics occurred during the winter or early spring months and a total of nine epidemics occurred during seven different months of the year, it would seem that there is no particular season for its appearance but that an outbreak of this disease depends on the association of an unprotected water-supply and the possibilities of sewage pollution; among other evident factors controlling the latter an unusual precipitation is of some importance. There is, however, some reason to believe that infections by members of Type 1 are more common during the summer months. It has been stated that young persons, particularly those between 20 and 30, are unusually susceptible. For this reason a tabulation of the cases occurring in Bethlehem with reference to age periods is introduced. It will be noted that practically no age period from the first to the seventieth year was spared and that while there is an apparent partial immunity beginning with the sixtieth

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year, it should be recalled that the proportional number of persons over this age is less in number than for younger age periods.

Age Period.	No. of Cases.
0 to 4	60
5 to 9	29
10 to 14	20
15 to 19	31
20 to 24	47
25 to 29	27
30 to 34	29
35 to 39	20
40 to 44	31
45 to 49	15
50 to 54	21
55 to 59	22
60 to 64	18
65 to 69	12
70 and over	19
Information refused	7
	408
Males	193
Females	215
	408

MORTALITY

As has been shown by the study of infections by Type 1 there is a very wide range of mortality; that given by Shiga for Japan is from 22 to 26 per cent.; by Kruse for Germany, 10 per cent.; by Rosenthal for Russia, 12 to 17 per cent.; and Manson states that while Europeans in India suffer a mortality of 3 to 22 per cent., the native loss is 36 to 40 per cent. Park, in studying infections by mixed types in and about New York City, found that there was a mortality of 6 per cent; about 50 per cent. of the cases studied by him showed the *B. dysenteriæ* (Shiga-Kruse) in the feces. The clinical course was severe and the mortality high as contrasted with the other cases studied. In the feces of the other 50 per cent. various strains of the other two types were found. No age periods are mentioned by him. The mortality of epidemic dysentery in Pennsylvania has not been studied except in the instance of Bethlehem, where

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but four cases, or less than 0.4 per cent., resulted fatally. It should again be recalled that the Bethlehem epidemic was in all probability caused by a strain belonging to Type 2.

The average annual death-rate in the registration area of America for the years 1906 to 1910, inclusive, was 595,734. Of these 496 are credited to cholera nostras, 2,947 to dysentery, 35,226 to diarrhea and enteritis under 2 years of age and 7,110 to diarrhea and enteritis over 2 years of age. From these figures it is obviously impossible to estimate the number of deaths from acute bacillary dysentery since there are included under the four titles cases of bacillary dysentery diagnosed as "summer diarrhea," acute colitis, acute enteritis, the various chronic inflammatory conditions of the gastro-intestinal mucosa and also acute and chronic conditions not bacillary in origin. These will be referred to in a separate contribution.

Unquestionably epidemics differ widely in severity, depending on the type of microorganism, its casual relation to other pathogenic forms, and, to some extent, the degree of sewage pollution.

EPIDEMIOLOGY

While cultural characteristics, agglutination reactions and bacteriologic phenomena make it possible to distinguish sharply between types, the process resulting from the infection by any type is a pathologic one and becomes the problem of the epidemiologist. The most important source of infection, as in typhoid fever, is the patient himself, and the care of the dejecta constitutes the most important sir[illegible] of sanitation.

[illegible]dis[illegible]ic in a large portion of the world [illegible]he ca[illegible]widely distributed [illegible]irre[illegible] infection of the [illegible]y b[illegible] a lumber camp [illegible]bowel[illegible]sted and the sew-[illegible]ed o[illegible]he stream. At Erie

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and Bethlehem the infection was unquestionably caused by microorganisms from the sewage of the residents of each city. The occurrence of cases secondary to large numbers of sporadic cases cannot be estimated.

There is no doubt that many persons are infected by contaminated food, particularly meat, milk and ice-cream; contact infection, especially in epidemics, occurs through the medium of infected clothing, infected food and the ubiquitous fly. In addition, the organisms belonging to this group have been found in the feces of healthy persons and in the intestinal mucosa of individuals who had no other evidence of dysentery; the possibility of infection by carriers is so demonstrated.

RELATION TO TYPHOID FEVER

The relation of bacillary dysentery to typhoid fever depends entirely on the casual association of the two forms of microorganisms in the sewage-polluted source of infection.

The simultaneous appearance, however, of a number of cases or the presence of a spontaneous epidemic of acute dysentery should be the indication for immediate investigation and abatement of the source of infection. If typhoid bacilli should be associated it will be the means of lessening the number of cases. Those already infected will show an onset some two weeks after the beginning of the subsidence of the dysentery outbreak. This is graphically shown in Charts 1, 2 and 3, of the Ohio Valley, Erie and Bethlehem epidemics. The average period between the beginning of the subsidence of reported cases of bacillary dysentery and the onsets of the typhoid fever cases is fourteen days, the least recorded period being ten days, the greatest, twenty-one days. In the nine epidemics of dysentery studied there is a record of at least 55,000 cases of acute bacillary dysentery in a total population of 152,000; that is, 36 per cent of the population suffered from that one preventable disease. In five instances, or in 55 per cent.,

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notable increases in the number of cases of typhoid fever developed, 1,320 having occurred immediately after. The mortality for the latter was 14.6 per cent.

CONCLUSIONS

The following conclusions seem to be warranted by this study:

1. Bacillary dysentery should always be a reportable disease.

2. Sufficient power should be given to the health authorities to investigate and abate any suspected source.

3. Less confusion to the general practitioner results from a nomenclature broad enough to include all types of the causative organism.

4. While there is some warrant for the terms "dysentery" and "paradysentery," the more general one of "bacillary dysentery," in so far as preventive medicine is concerned, simplifies the problem both of diagnosis and of sanitary supervision.

5. There is apparently a notable lack of recognition of the etiology and probably of the pathology of cases infected by members of the dysentery group, resulting in a longer continuance of the infecting source and a higher mortality; this is evidenced in the varied diagnoses such as "diarrhea," "winter cholera," "intestinal grip," "grip," "gastric fever," "intestinal disorder" and many others.

6. Dependent on the casual association of the *B. typhosus,* outbreaks of bacillary dysentery may be followed within ten to twenty-one days by a marked increase in the number of typhoid fever cases. This occurred in five out of nine instances in Pennsylvania and may serve as a warning of the presence of the more serious infection; the immediate abatement of the sources would probably decrease the morbidity and mortality due to typhoid fever.

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7. When it is recalled that the major number of cases of bacillary dysentery are mild in form, being caused by Types 2 and 3, that sporadic cases probably exceed the total numbers occurring in epidemics; that sporadic cases probably account for the large proportion of deaths under 2 years of age accounted for statistically as cholera nostras, dysentery and diarrhea and enteritis; that the disease is reportable in only seven states and territories; and that in the latter the law is not enforced, the only conclusion is that we have no definite collective information about the morbidity and mortality of the infection which properly should be called bacillary dysentery.

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ABSTRACT OF DISCUSSION

DR. C. HAMPSON JONES, Baltimore: In our municipal laboratory we examine for the *Bacillus typhosus*, as well as for the paratyphoids. There is a regular process of examination of every specimen that comes in.

DR. RICHARD COLE NEWTON, Montclair, N. J.: I could not help but take particular heed to what Dr. Hunt said about Bethlehem, as Bethlehem has been infecting the city of Trenton. We have been getting 100 cases there at a time on the Delaware River, and it is supposed that they all start from Bethlehem.

DR. A. PARKER HITCHENS, Glenolden, Pa.: Some time ago I had occasion to look up the literature on paratyphoid fever. I was rather astonished to learn how very prevalent it is. Attention has been called to this fact a number of times but general interest has not yet been aroused. Wells stated that about 10 per cent of the cases in Chicago diagnosed as typhoid fever are actually paratyphoid. Kolle makes the same estimate for Germany, while Boycott found in London from 3 to 3.5 per cent. An epidemic of paratyphoid infection in this country was reported by Lyons in the *New Orleans Medical Journal*

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about, I think, in 1910. The bacillus responsible for the epidemic was of the A type. The usual impression is that paratyphoid B infections are much more commonly diagnosed as typhoid fever than are infections by the paratyphoid A bacillus. Lyons believes that paratyphoid A is the more frequent offender, in New Orleans, at least.

He was the first to suggest the use of a mixed typhoid vaccine. If paratyphoid infection is anything like so prevalent as has been stated—10 per cent. of the conditions diagnosed as typhoid fever—even though the mortality-rate be not high, not more than 1, or 2, or 3 per cent. ordinarily, the economic loss due to the illness and enforced idleness is so great that there would seem to be no reason why we should not add the paratyphoids to the regular typhoid vaccine, as mentioned by Dr. Russell.

A short time ago I started an investigation to find out what bacteria are concerned in the infection in typhoid fever after ulceration has developed. I feel that the treatment of typhoid fever by a single vaccine, that is, a vaccine composed of typhoid bacilli alone, is not adequate at this stage. Once in a while therapeutic inoculation with typhoid vaccine is followed by remarkably brilliant results. We feel that at such times, in such cases, the infection is a pure typhoid infection. In other cases the typhoid vaccine seems to do no good at all; and these things happen so frequently that nobody can predict a favorable result. After ulcerations have developed, that is, after the second or third week, when typhoid patients usually reach the hospitals, the disease is not, bacteriologically speaking, a typhoid infection, but is a mixed infection and if one could prepare a suitable mixed vaccine, positive results from therapeutic inoculation might be more frequent.

Dr. C. J. Hunt, Harrisburg, Pa.: I understand that in the laboratory in Baltimore the agglutination reaction has been worked out in every case of typhoid fever with *Bacillus typhosus* and all other group members. I should like to be informed whether I am correct in that understanding.

Under the direction of Dr. Dixon I made a tabulated list of the cases of typhoid fever occurring in the Lehigh Valley District, in order that they might know from where some of the typhoid organisms originated which were found in the Delaware. There is no doubt that much sewage escaped disinfection. The German statistics showing a mortality of 10 per cent. are probably more nearly correct, as the details worked out in establishing a diagnosis were studied more carefully. One point which seems confusing in the reports of German investigators is the apparent failure to differentiate between *Bacillus typhosus* B and the Gaertner bacillus. There is no sharp differentiation between paratyphosus B fever and meat-poisoning cases, from which the Gaertner bacillus has

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been isolated. It is my hope to make a report of these infections later.

The frequent occurrence of paratyphosus A infection has already been noted and is a matter of comment among those working in this field, particularly as to the differentiation between *Bacillus paratyphosus* A and *Bacillus typhosus*. There is apparently a group agglutination for these two microorganisms, a factor which can be determined only by observations on the titer limit in every case. My conclusions in the Coatesville epidemic were that we were dealing essentially with A infection, though I did not advance it as a portion of my paper. Had more extended observations been made there would be some justification for making a definite statement with reference to it. In South Bethlehem during the epidemic of *Bacillus typhosus* infection, I had an opportunity, through the treasurer of the Bethlehem Steel Works, acting for Mr. Schwab, to immunize about 10,000 employees. The result of the first day's work in that borough by ten census-takers showed that the outbreak was already abated and the enforced vaccination would have been scarcely justifiable. The use of vaccine in mixed infection is one I hope to work out in Pennsylvania. I shall, I think, have an opportunity in connection with further studies on this group of microorganisms. The latter will include studies on the titer limit, saturation and bactericidal properties.

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ANTITYPHOID INOCULATION: THREE YEARS' EXPERIENCE WITH ITS USE IN TRAINING SCHOOLS FOR NURSES IN MASSACHUSETTS

LESLEY H. SPOONER, M.D.
BOSTON

Pfeiffer's experiment, which led Wright to introduce anti-typhoid inoculation into the British Army, was more far-reaching than one could have imagined at that time. All are familiar with the extensive work which has been accomplished on these lines in the English, German and United States armies.

Inoculation material has been most varied. Heat-killed vaccines have been the most popular and in fact the only preparation used to any considerable extent in man. But animal experiments and a few human inoculations have been attempted with other material. Vincent[1] recommends macerated organisms sterilized by ether. Müller[2] has treated cultures with lecithin and extracted the product with chloroform. Rusznyák[3] has used the typhoid immune serum, while Besredka[4] and Bessau[5] have employed mixtures of the serum and dead organisms. Chemical agents such as silver salts, glycerin, sodium carbonate, formaldehyd solution and phenol (carbolic acid) have been widely used to sterilize cultures. Macfadyen[6] has employed frozen, powdered

1. Vincent: Bull. de l'Acad. de méd., Paris, 1910, No. 24. p. 615.
2. Müller: Ztschr. f. Immunit. u. exper. Therap., 1910, i, Part 5, p. 587.
3. Ruszynák: Centralbl. f. Bakteriol., 1911, 1 Abt., lviii, 134.
4. Besredka: Ann. de l'Inst. Pasteur, 1902, xvi, 918.
5. Bessau: Centralbl. f. Bakteriol., 1911, 1 Abt., lix, 549.
6. Macfadyen: Brit. Med. Jour., 1903, i, 882.

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and filtered organisms. But the most extreme method is that of Castellani,[7] who employs on his third and fourth injection living organisms which have been attenuated by an exposure to 50 C. The advantages and disadvantages of these methods, although worthy of prolonged discussion, cannot be considered at the present moment.

All practical work has been accomplished in artificial typhoid immunity by means of heat-killed vaccines. Pfeiffer and Kolle[8] and Wright[9] recommend heating to 60 C., but Leishman[10] and Russell[11] advise only 53 C. In my work I was guided by the careful researches of Major Leishman[10] and others of the British Commission,[12] whose work alone at that time seemed complete.

It is well recognized that the typhoid bacillus is the greatest foe to the soldier in the field. During the last century nearly all the armies of the civilized world have been devastated by this infection, but the dangers of typhoid communication were not fully realized until the discovery of the specific organism by Eberth in 1880, and its demonstration in the various excreta of the body which followed shortly.

It was shown by Joslin and Overlander[13] that the nurses of Massachusetts were eight times more liable to typhoid infection than others less intimately associated with the sick. For the ten years ending 1908, two to four nurses contracted typhoid fever in the Massachusetts General Hospital alone. According to my statistics[14] there was a morbidity of 1.4 per cent. among the nurses as compared with Joslin's of 1.41 per cent. among the nurses of most of the large hospitals of Massachu-

7. Castellani: Centralbl. f. Bakteriol., 1909, 1 Abt., lii, 92.
8. Pfeiffer and Kolle: Arch. f. Schiffs- u. Tropen-Hyg., 1905, ix, 327.
9. Wright: Brit. Med. Jour., 1897, i, 256.
10. Leishman: Jour. Roy. Med. Corps, 1907, viii, 463.
11. Russell: Johns Hopkins Hosp. Bull., 1910, xxi, 83.
12. Harrison: Jour. Roy. Arm. Med. Corps, 1907, viii, 472; Leishman, etc., ibid., 1908, x, 583, xi, 327.
13. Joslin and Overlander: Boston Med. and Surg. Jour., clvii, 427.
14. Spooner: Am. Jour. of Pub. Hyg., 1909, xix, 616.

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setts. This unnecessary prevalence of typhoid fever in the best regulated of our hospitals caused Dr. Mark W. Richardson, secretary of the State Board of Health, who had long been interested in the disease and its prevention, to bring the matter before the governing boards of the Massachusetts General Hospital. Their response was prompt and decisive so that inoculation was started there at once and has been continued regularly to the present time.

In order to produce immunity in such a class of individuals it was necessary to demonstrate the safety of the process and the relative ease with which it could be accomplished. To bring about this result I proposed the use of small doses, frequently repeated, of a low virulence vaccine. My vaccine material was and still is essentially the same as that used by Leishman and Russell.

TECHNIC

In my work the technic is briefly as follows: The stock culture was isolated from the spleen of a patient with typhoid fever in 1902, so that its attentuation has been considerable. Its killing power with animals is one-fourth that of a similar culture only 1 year old. The organisms grown on agar slants for twenty-four hours, are killed by an exposure to 53 C. in the water-bath for an hour. Standardization is made with the Zeiss blood-platelet counter. Injections are four in number and are given at five-day intervals. The doses, which vary somewhat with the size of the individual, are 100 million, 200 million, 400 million to 600 million. For small women and children the amount of the vaccine is proportional to the body weight.

The site of injection is preferably in the left interscapular region, but many inoculations have been performed at the insertion of the left deltoid. The latter seems less convenient because of the considerable muscular activity in the neighborhood of the swelling which occurs in almost all instances. Alcohol is used as a local

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antiseptic. When large numbers are to be inoculated at one time several syringes are used which are boiled between injections, care being taken to cool the syringe before vaccine material is introduced.

REACTION

It is a well-recognized fact that debilitated persons present the most profound reactions, and I have observed that latent and chronic disease of a non-typhoidal character may be made active by an inoculation. I have avoided vaccination in such individuals—especially tuberculous patients, but I have suffered a few accidents through improper histories. In this way a temporary but not serious acute exacerbation has taken place in three patients with chronic arthritis, in a patient with chronic cholecystitis, one with subacute urethritis and in patients with quiescent cases of furunculosis and acne. The duration of these untoward effects was very short.

The safety of my work necessarily calls forth a discussion of the "negative phase" so strongly supported by Wright, Morgenroth and Vincent. Since many of the nurses are exposed to the disease during inoculation a period of diminished resistance would be of great danger. Pfeiffer, Leishman and Russell have shown that the period following injection is one of increased resistance, however. This is in perfect accord with the small morbidity of typhoid among these nurses and eighty others who were most intimately exposed to the disease before and during inoculation. In this light it is interesting and important that few inoculated during the incubation period presented a milder form of the disease than those from whom the infection arose.

The reactions have been reasonably slight. Locally the site of inoculation presents a tender, painful wheal. When a vein is accidentally punctured a more severe local reaction results, the swelling and ecchymosis persisting several days. The neighboring lymphatic glands may become enlarged and tender, but the duration of the

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latter symptom is short, and the local soreness rarely lasts longer than from twenty-four to thirty-six hours. The constitution reaction in my latest personal cases, some 400 in number, is as follows:

Absent or slight.....	86 per cent.
Moderate; i. e., malaise, headache and fever not exceeding 100.5 F.	10 per cent.
Severe; i. e., vomiting, diarrhea and chills and fever reaching 102 to 103 F.....	4 per cent.

These symptoms last from twelve to twenty-four hours, rarely forty-eight hours. Furthermore, in only five instances has a moderate or severe reaction been produced in any individual by more than one of the four inoculations. Fifty per cent. of the moderate reactions followed the second injection, the first and third dividing the remainder nearly equally. Among the severe reactions 50 per cent were produced by the third, the first and second dividing the remainder. Only very rarely does the fourth inoculation produce any discomfort. I have observed that when inoculation is started on the eve of catamenia or during the early days of flow, constitutional reactions are apt to be more severe. As a result, I plan as far as possible not to have the first two injections fall within those days.

HOSPITAL INOCULATION

During the first year my work was limited to the Massachusetts General Hospital, but since that time inoculations have been performed by me or under my supervision among the nurses and others intimately exposed to the disease in twenty-three hospitals in Massachusetts, through the efforts of Dr. Richardson. In all, 1,585 individuals have received this treatment. The result of hospital inoculations is told in a word by the following tabulation:

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Individuals inoculated in hospitals.....	1,361
Individuals uninoculated (but exposed) in same hospitals	674
Cases of typhoid among the inoculated—excluding 3 who were inoculated during the incubation period (one of these was a paratyphoid infection).....	3
Cases of true typhoid among inoculated...	2
Cases among the uninoculated (9 of these were paratyphoid cases).....	17
Cases of true typhoid among uninoculated.	8
Morbidity among inoculated.....	0.15 per cent.
Morbidity among uninoculated.....	1.19 per cent.

The last figure is somewhat lower than those of Joslin[13] and myself[14] quoted above. But it shows what may be expected among such large numbers of nurses unprotected by inoculation. The marked reduction among the inoculated needs no further comment. The two cases contracted among the inoculated occurred in the following manner: One nurse, a year following inoculation had attended outside her hospital two typhoid patients who died. Her disease was severe but was followed by recovery. The other, two years after inoculation, while caring for several patients, received in the mouth some typhoid material. Although the mouth was washed with antiseptics a mild infection followed.

In the Massachusetts General Hospital where inoculation has been in progress for three years and where over 80 per cent. of the nurses and others exposed to typhoid have been protected, no cases of typhoid fever have been contracted. Table 1 illustrates exposure in the medical wards during the typhoid season of ninety nurses who had completed their course and ninety-two who were still in training.

The high percentage of inoculated nurses serving night duty during the typhoid season is most suggestive, since that class furnishes most of the cases of the contracted disease. In all fairness it must be stated, however, that rather fewer cases of the disease have been treated in the hospital during this three-year period.

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TABLE 1.—EXPOSURE OF NURSES IN WARDS DURING TYPHOID SEASON

	Av. Months of Typhoid Duty.	Av. Months of Typhoid Night Duty.	Percentage of Nurses Serving Night Duty During Typhoid Season.
Pupils	2.42	0.54	42
Graduates	2.88	0.64	57
Total	2.64	0.59	44

But this reduction is in no way proportional to the decrease of the incidence above noted.

BLOOD CHANGES

Agglutination reactions have been performed by the microscopic method because of its ease, accuracy and its moderate value. The first hundred cases showed positive reactions in the following dilutions two weeks following inoculation:

1:50 or greater..... 80.6 per cent.
1:25 or greater..... 94.2 per cent.

Macroscopic agglutination reactions at an equal interval show positive results varying between 1:1,000 and 1:10,000. This quality of the blood persists to a considerable degree for two years, but is still evident after two and one-half years.

That an immunity exists in the presence of a positive agglutination reaction of even mild degree is most reasonable. But the converse is not true, since all are familiar with the usual transient character of the antitropic substances of the blood following an attack of the disease itself. Further investigations of blood changes, i. e., bacteriolysins, opsonins, etc., have not been carried out, since those points are now well established.

EPIDEMICS

The employment of this treatment in epidemics has been meager. This has been due no doubt to the fear

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of the so-called "negative phase." It has been attempted twice by me. In one instance the infection proved to be paratyphoid, and the results, though interesting, are of no great value. They are as follows:

Morbidity among uninoculated.....	12	per cent.
Morbidity among inoculated.....	6.6	per cent.

These figures are somewhat striking since each class embraces an equal number of individuals. Over 80 per cent. were inoculated during the incubation period, a fact which detracts considerably from the value of the

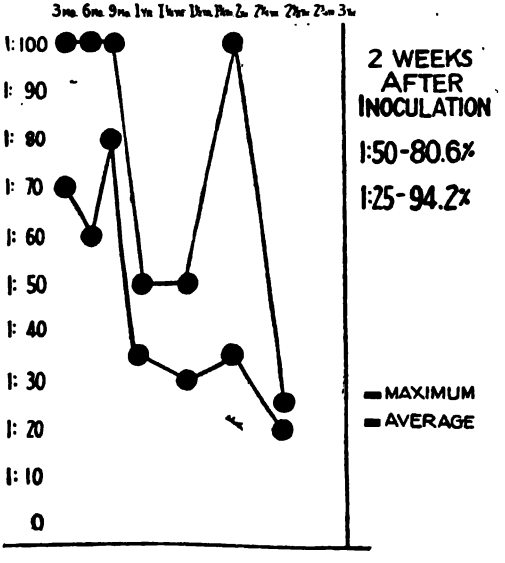

Figure 1.—Microscopic Widals.

statistics. But in spite of this, there is a considerable reduction of morbidity and only two cases appeared after inoculation was completed. Inoculation during this epidemic was of doubtful value.

The second epidemic was of greater interest and the results proved more satisfactory. The water-supply of a limited number of people in a little Vermont village became contaminated with the typhoid organism from the excreta of an isolated individual who had died from

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the disease six months prior to the epidemic. The original primary cases, seventeen in number, appeared simultaneously (Fig. 2). Within a week twenty-nine of the remaining forty-eight who had been exposed to the disease through the water-supply had been inoculated. Nineteen remained uninoculated. Among the latter five cases developed, among the former one. The latter presented his first symptoms immediately following his first inoculation. His disease was of a very mild variety.

The small size of this epidemic forbids drawing too broad conclusions, but it seems rational to advise the

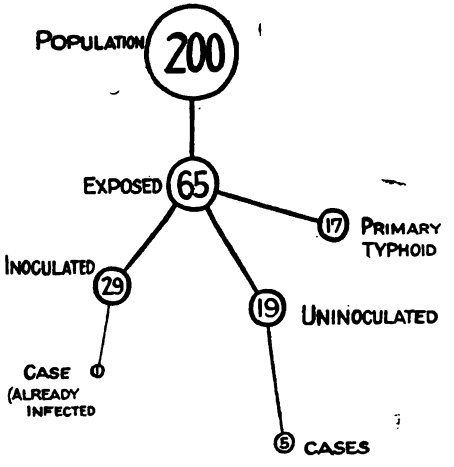

Figure 2.—Greensboro epidemic.

employment of inoculation, since no harm appears to result when the vaccine is given in a judicious manner. Furthermore, the absence of cases contracted among the inoculated in this epidemic and in several isolated cases of immediate exposure seems to be far from a coincidence. Inoculation in the time of epidemics must be performed with care, since it is inevitable that many must be inoculated during the incubation period. The result of this accident is not serious, however. My experience would indicate that the onset of symptoms was hastened by this step, but that the infection was shorter

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and of a less severe character, possibly because of the destruction of organisms before they had multiplied to a sufficient extent to produce a natural reaction from the unassisted body.

Including this epidemic and other personal cases the final statistics are as follows:

Inoculated individuals	1,585	
Uninoculated individuals	700	
Cases among inoculated (excepting those mentioned)	2	
Cases among uninoculated (with similar exceptions)	13	
Morbidity among inoculated		0.12 per cent.
Morbidity among uninoculated		1.86 per cent.

CONCLUSIONS

Frequent injections of small amounts of a low-virulence vaccine cause slight inconvenience.

They seem to produce a protection among nurses, who are eight times more liable to the disease than the average individual.

Their morbidity, under ordinary conditions, is 1.4 per cent, or nineteen cases among 1,361.

Only two cases developed under these conditions.

Case morbidity among the uninoculated in these hospitals is nearly nine times greater than among the inoculated, subjected to similar conditions.

No permanent untoward effects have arisen from over 5,000 injections.

The blood-picture indicates a certain protection lasting at least two and a half years.

The use of this means of protection has been shown to be safe in two epidemics and very efficient in at least one of them.

[NOTE.—I am deeply indebted for their careful work in completing subsequent inoculations and for excellent records of Dr. E. M. Crane, of Hardwick, Vt., and to those physicians in charge of the hospitals in which inoculation has been introduced.]

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SOME RESULTS AND FIELDS OF USEFULNESS OF ANTITYPHOID VACCINATION

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Since the results of our campaign against typhoid in Texas have become generally known, there has developed among the medical profession and the laity an active interest in typhoid prophylaxis by means of bacterial vaccines, and for this reason it is believed that a statement of our experience in the army and the present status of the subject may be of value.

To illustrate by comparison I shall refer to vaccination against small-pox, it being the only other measure of this kind which has been extensively used and carefully studied; we know positively that when vaccination against small-pox is thoroughly carried out the disease disappears; we also know that the duration of immunity following vaccinia is not so long as our forefathers believed. In Germany the vaccination of infants is compulsory and revaccinations are required at school age, at the age of compulsory military service and again if there be exposure to the disease, at least three separate vaccinations being required during a lifetime. There is a general belief among the profession and the laity in this country that the immunity conferred by vaccination becomes ineffectual after from seven to ten years. The British royal commission[1] in its final report dated 1896 drew the following conclusions:

The protection it affords against attacks of the disease is greatest during the years immediately succeeding the

1. Article on Vaccination, Encyclo. Britannica, Ed. 11.

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operation of vaccination. It is impossible to fix with precision this period of highest protection. Though not in all cases the same, if a period is to be fixed, it might, we think, fairly be said to cover in general a period of nine or ten years. . . . When revaccinated persons were attacked by or died from small-pox the revaccination had for the most part been performed a considerable number of years before the attack. There were very few cases where a short period only had elapsed between the revaccination and the attack of small-pox. This seems to show that it is of importance, in the case of any person specially exposed to the risk of contagion, that they should be revaccinated, and that in the case even of those who have been twice revaccinated with success, if a long interval since the last operation has elapsed, the operation should be repeated, for a third and even a fourth time.

Important further light on the subject is found in an article by Kitasato on "Vaccination and Small-pox in Japan."[2] As Japan is an island kingdom environed by unvaccinated countries in which small-pox is endemic, the disease in a virulent form is frequently introduced. Beginning with the year 1879 elaborate and careful statistics have been collected, which show quite definitely the gradual diminution of the immunity beginning with the second year after vaccination. Kitasato's table, based on 951 cases, is as follows:

SUCCESSFUL REVACCINATION AFTER:

1 year	13.6 per cent.
2 years	32.9 per cent.
3 years	46.6 per cent.
4 years	57.3 per cent.
5 years	51.1 per cent.
6 years	63.8 per cent.

Weil[3] reported in 1899 72.5 per cent. of successful revaccinations after seven years, 80 per cent after eight years, 85 per cent. after nine years and 88.6 per cent. after ten years.

Kitasato concludes that "the immunity acquired through vaccination begins to disappear during the

2. Kitasato, S.: The Journal A. M. A., March 25, 1911, p. 889.
3. Weil, quoted by Kitasato (Note 2).

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second year, and by the tenth it has almost completely disappeared."

We have, then, some definite facts regarding a successful prophylactic treatment with which to compare vaccination against typhoid fever.

DURATION AND DEGREE OF TYPHOID IMMUNITY

Two questions frequently asked are, "What is the duration of the immunity?" and "Is it absolute?" First, as to its duration: Our own experience, beginning as it does in 1909, is too recent to be of value. From the rich experience of the British army in India Colonel Firth[4] concludes that immunity begins to diminish in about two and one-half years after inoculation. His tables also show that even after four and five years, the maximum period of observation, the rate per thousand among the inoculated is, roughly speaking, only one-fourth that of unprotected troops.

In the early days there was a tendency to consider that this immunity lasted for little more than a year, since agglutinins disappeared from the serum at about this time, but we know that agglutinins are present as long after vaccination as after typhoid fever, which gives, as a rule, protection for life.

As a matter of fact, we do not yet know definitely the duration of immunity following antityphoid vaccination; it begins to diminish at about the same time as immunity to vaccinia and it is possible that it may last nearly if not quite as long.

We know also that the immunity is not absolute, for in 1911, among 80,000 persons vaccinated in the army, there were twelve cases of typhoid with one death (due to intestinal hemorrhage); and in 1910 there occurred six cases among the vaccinated with no fatalities. Had it not been for the prophylactic immunization there would have occurred, at the prevailing rates of incidence, about 250 cases. The fact that the immunity is not

4. Firth: Jour. Roy. Army Med. Corps, 1911, xvi, 589.

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absolute is no objection to its use, but is rather an argument for its repetition at intervals to be determined in the future as the lessons of experience become clear, just as we now do in the case of small-pox. It is our present practice to revaccinate against both small-pox and typhoid at the beginning of each three-year period of enlistment.

The failure to secure absolute protection in these few cases may be due to inefficiency of the vaccine, to exposure of the patient to exceptionally large quantities of infectious material or inability of the individual to respond to immunization with the usual antibodies; and this failure can best be interpreted as a personal idiosyncrasy.

With the limited number of doses of vaccine now used we can never hope to raise the immunity high enough to protect against overwhelming doses of infectious material and there are, no doubt, certain persons who cannot be completely protected against typhoid any more than against small-pox. We know that certain horses cannot be profitably used for the production of antitoxin and that not all laboratory animals respond equally to immunization.

Although we may fail in exceptional instances to prevent infection it is probable from our experience that the severity of the disease is modified and the death-rate lowered.

These comparisons prove that in antityphoid vaccination we have a method for the prevention of disease which approaches in efficiency if it does not equal the prevention of small-pox by vaccinia.

USE OF THE TYPHOID PROPHYLACTIC

The vaccine, or typhoid prophylactic, as we style it, consists of a suspension of dead bacilli in salt solution to which is added 0.25 per cent of tricresol as a measure of safety. The vaccine is accurately standardized by counting the bacilli; 500 millions are given as the first

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dose and 1,000 millions each for the second and third, ten and twenty days later. The skin of the upper arm is sterilized with iodin and the vaccine is injected subcutaneously. There is a local reaction consisting of a small red and tender area lasting about forty-eight hours. The general reaction, when present, gives rise to a headache and malaise and sometimes to fever, chills and occasionally to nausea, vomiting or diarrhea. The severe reactions are exceptional and do not occur in more than from one to three persons per thousand. The occurence of a severe reaction need not give rise to anxiety since they all pass off quickly and leave no trace. We have always insisted that only the healthy should be vaccinated, since a severe reaction in one weakened by disease might do harm. No precautions are taken after vaccination other than to warn against the use of alcoholic drinks and severe exercise. No hard work is required of troops during the following twenty-four hours, but they are not excused from ordinary routine work, as a rule. At one recruit depot during the past ten months 6,690 men have been vaccinated three times, making over 20,000 vaccinations; and only 223 men were excused from duty as a result, or about one in ninety; this record is probably higher than would occur were it not for our custom of vaccinating simultaneously against small-pox on one arm and against typhoid on the other. If the vaccinia is severe, the second dose of antityphoid vaccine is postponed a few days, but it has not been necessary to deviate in any other way from this routine.

RESULTS OF ANTITYPHOID VACCINATION

The total number of doses of our vaccine which have been used up to the present time is over 400,000, and no bad results have been reported; thanks to the efficiency of iodin as an antiseptic and the presence of 0.25 per cent. tricresol in the vaccine there have been no skin infections. We have always insisted that the dose be

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given subcutaneously and never into the muscle, since slow rather than rapid absorption is desired. In such a large number of hypodermic injections one might expect some accidental complications, yet only one has been reported, a case of temporary musculospiral neuritis. It is well to remember, however, that none but healthy persons should be immunized with the dosage used by us; by diminishing the quantity and increasing the number of doses it should be possible to immunize almost any one regardless of age or health. The present dose is arranged for a healthy man weighing 150 pounds, and is diminished for women and children in proportion to their weight.

The value of the protection given against typhoid fever can best be shown by stating briefly the results obtained at San Antonio and along the Mexican frontier during the spring and summer of 1911, and by contrasting these figures with the records of the Spanish War.

A division of troops, about 20,000 men, was mobilized in Texas and along our southern boundary as far west as San Diego, Cal., in March, 1911; they remained in camp and on march for a period of over four months; then the majority returned to permanent army posts. Immediately on the receipt of orders for mobilization the Surgeon-General made arrangements for compulsory vaccination of the entire command, with the exception of a few persons over 45 years of age. The vaccine was prepared at the Army Medical School, and sent forward as rapidly as it could be used. The immunization was carried out after the troops arrived at their destination and while they were under canvas without interfering with their work. As a result we have to record only two cases of typhoid, one in Texas and one in California, both ending in recovery, in the entire number of troops in the field.

In 1898, during the Spanish War, there were assembled at Jacksonville 10,759 troops among whom there were certainly 1,729 cases of typhoid, and including those

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probably typhoid, 2,693 cases, with 248 deaths. This camp lasted approximately as long as that at San Antonio; the number of men was less by about 2,000; the camps were situated in about the same latitude and both were furnished artesian well water; yet in 1898 there were over 2,000 cases and 248 deaths and in 1911 there was one mild case. We know that this immunity was not due to lack of exposure since the fever prevailed to a considerable extent in and around San Antonio. To be sure, our camps were more hygienic and sanitary than any we have ever had before, and the sick-rate from all causes was low, yet the men were permitted to visit town, where they became, for the time, a part of the community and were exposed to the usual sources of infection; yet there was almost complete absence of typhoid fever. This circumstance should leave no doubt of the value of antityphoid vaccination, since it is apparent that perfect camp sanitation cannot explain the immunity enjoyed by those who left camp. It is highly probable that there were also a few chronic bacillus-carriers among our own men, yet owing to vaccination and the excellent sanitation of the camps, the men remained healthy. Protection of the individual by vaccination is the only measure of protection independent of surroundings and effective under all conditions.

Compulsory vaccination in the southern maneuver camp was ordered March 9; the order was made applicable to all recruits for the army June 9, 1911, and was extended to include the entire personnel of the army under 45 years of age, Sept. 30, 1911. It follows that the number of men vaccinated increased by leaps and bounds; at the commencement of the year not more than 15,000 had been immunized while at the end there were over 55,000. If vaccination gives the protection which we believe it does, it should show in the total number of cases occurring during 1911, and the accompanying table has been prepared to show the statistics for the

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past four years. In considering this table it is well to remember that 1911 was a year of unusually great exposure, due to an extraordinary amount of field service.

DECREASE IN TYPHOID FOLLOWING ANTITYPHOID VACCINATION

Year.	Cases		Deaths		Vaccinated Persons	
	No.	Ratio per 1,000 Mean Strength.	No.	Ratio per 1,000 Mean Strength.	Cases.	Deaths.
1901	552	6.74	72	.88	..	..
1902	565	6.99	69	.85	..	..
1903	348	5.14	30	.44	..	..
1904	280	4.77	20	.33	..	..
1905	193	3.39	17	.29	..	..
1906	347	6.15	15	.26	..	..
1907	208	3.87	16	.29	..	..
1908	239	3.20	24	.31	0	..
1909	282	3.35	22	.26	0	..
1910	198	2.43	14	.17	0	..
1911	68	0.82	8	.097	12	1
1912*	7	0.20	1	.003	3	0

* Ratio for 1912 based on experiments for first half year.

For the present year, 1912, there have been reported during the first six months, seven cases, only three of which were in immunized persons; two of the remaining four developed in recruits within two weeks of the date of their entry into the service; should this rate continue we should not expect more than fifteen or twenty cases during the entire year.

The statement of these three results: those obtained in the Southern Maneuver Division, in the whole army in 1911, and in the first four months of 1912, should convince any one of the high protective value of this form of prophylaxis. Excellent results have been obtained in the past, particularly by the British in India, yet as the measure was to a certain extent a voluntary one, the objection has been made that the statistics conveyed a false impression as to its value, since the men who volunteered, being careful and thoughtful individuals, would probably not have contracted the disease in any event. This objection we have disposed of in our service by making the vaccination obligatory on every person under the control of the commanding

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general. In fact, it is difficult to conceive of a more complete and thorough-going test of any measure than has been given this, and the results are evident.

FEASIBILITY OF GENERAL INOCULATION

A word as to the necessity for this form of prophylaxis. It is generally admittd by the opponents and more numerous luke-warm adherents of antityphoid vaccination, that it is essential for the Army and the militia of the several states, in times of war and mobilization. Has it not, however, a field of usefulness in civil life in this country? It has been repeatedly shown that the incidence of typhoid fever is higher in hospitals than in the cities in which the hospitals are situated,[5] and there is pretty general agreement that the medical and nursing staffs and employees should be vaccinated. For the same reason all who in any way come in contact with the sick should be immunized, since typhoid, like other exanthems, is contagious during the prodromal stage.[6] In this group we may place the personnel of dispensaries, various charities and undertakers.

Another large group comprises those who live in industrial villages, mining towns, isolated communities where the typhoid death-rate is above the average. Workhouses, asylums and especially schools come in this category.

There is another large group of persons living under conditions simulating those occurring with an army in the field, although without the same sanitary safeguards. I refer to the camps of engineers, contractors and pleasure seekers. Here, if anywhere, the use of the typhoid prophylactic would richly repay the time and trouble necessary for its administration. Its usefulness, however, is not limited to these classes of persons. The typhoid death-rates for New York, Boston, Chicago and most other large cities in the North are low, varying from

5. Richardson and Spooner: Boston Med. and Surg. Jour., 1911, clxiv, 8.
6. Conradi: Klin. Jahrb., 1907, xvii, 297.

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4.7 in Bridgeport, Conn., to 17.5 in Philadelphia, and as long as the inhabitants of these cities remain at home they run little danger of contracting the disease. Remaining at home, however, is a thing most of us do not do; we send our patients, families and go ourselves to the seaside and mountains where the typhoid rate is five and ten times as high as at home. In the cities we depend on pure water, proper disposal of wastes and the intelligent activities of an energetic municipal health department. In going into the country or traveling from place to place where the usual safeguards are lacking, why not avail ourselves of this form of individual prophylaxis which is efficient in all places and at all times?

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INOCULATION AGAINST TYPHOID

IN PUBLIC INSTITUTIONS AND IN CIVIL COMMUNITIES: A FURTHER REPORT*

F. W. HACHTEL, M.D., AND H. W. STONER, M.D.
BALTIMORE

Since the experimental inoculations of Wright[1] and of Pfeiffer and Kolle,[2] in 1896, immunization against typhoid fever not only has been tested out in various armies and proved of inestimable value in reducing the number of cases of this disease in military camps, but also has been used in hospitals to lower the attack-rate among nurses and attendants. More recently, even certain state and city boards of health have adopted this procedure in their fight against typhoid.

The utility of this measure in military life is settled beyond debate, while its usefulness in protecting those exposed to infection in hospitals cannot be disputed. Indeed, it is our belief that the time is not far distant when those in charge of such institutions not offering this means of protection to their nurses and attendants will be considered culpably careless.

Again, it is our firm conviction, based on results we have obtained, that inoculation against typhoid is adaptable to preventing epidemic and sporadic cases in public institutions, particularly those for the insane and feeble-minded.

The advisability of extending typhoid vaccination to civil communities at large, however, may be considered

* From the Bacteriologic Laboratory of State and City Boards of Health.

1. Wright: Lancet, London, Sept. 19, 1896.
2. Pfeiffer and Kolle: Deutsch. med. Wchnschr., 1896, xxii, 735.

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an open question. It might be argued that the various measures now used in the war against enteric fever are all that are essential; that if cities and towns direct their attention to obtaining pure water, clean milk, the proper disposal of sewage, and freedom from flies; if shell-fish and green vegetables are obtained from sources above the suspicion of pollution; and if reports of all cases of typhoid fever are followed by placarding the houses, screening the patients and disinfecting the excreta, bedding and utensils likely to be contaminated by such excreta, it will be unnecessary to add typhoid vaccine to their armamentarium.

Such a position, however, seems little more tenable than to hold that they should direct their attention to the proper disinfection of the dejecta to the exclusion of all other means of prevention. For our large cities, much less our smaller towns, have not attained, and in the near future are not likely to attain, this advanced state of sanitary control over the above-mentioned carriers of infection. In the meantime are they content to remain supine and to allow the annual sacrifice without offering their poorer citizens this method of prophylaxis, and without at least advising its adoption by those citizens who can afford to do so? Again, even in a community in which this ideal of sanitation is an accomplished fact there would still be the bacillus-carrier, the contact case and the danger of introduction from without either by visitors or by residents.

When all things are considered we feel that there is a field for antityphoid inoculation in the prevention of enteric fever in civil life, and that those state and city boards of health that are supplying vaccine to the citizens of their respective states and cities are acting wisely.

For more than two years the department of health of Baltimore has furnished vaccine to the various hospitals within the city, and it has recently decided to give it free to citizens who are unable to purchase it.† The state

† Since this paper was read the distribution of vaccine has been extended to all citizens.

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department of health of Maryland since the summer of 1911 has prepared antityphoid vaccine for several state institutions. Altogether, since March, 1910, between 2,700 and 2,800 persons have been inoculated with vaccine from the conjoint laboratory of the state and city boards of health, and reports have been obtained from 2,044 of these, we ourselves having immunized only 140 of this number.

The immunization of 650 of the 2,700 and odd has not been completed, so that no report of the reactions can be made at present. This includes 250 citizens of a town of 6,000 inhabitants, in which there are certain districts showing an excessive attack-rate. The other 400 are inmates of Springfield State Hospital. In addition to these the inoculation of volunteers from the unvaccinated members of the Fourth Infantry, Maryland National Guard, is in progress. The number of these is at present not ascertainable.

Of the total number of those from whom we have procured records, 309 were resident physicians, nurses and attendants in general hospitals; 1,551 were inmates, nurses and attendants in two state hospitals for the insane, and 184 were private citizens of Baltimore and of rural districts. This latter class includes physicians, nurses in private practice, medical students, commercial travelers, laboratory workers, members of infected households and people going to summer resorts; in short, persons specially exposed to infection.

Table 1 shows in detail the distribution of the 2,044 persons from whom reports have been obtained.

Before analyzing the reports thus far received we shall briefly describe the preparation of the vaccine employed. This has been prepared in two different ways. At first it was made from a mixture of six different strains of *Bacillus typhosus,* five of which had recently been isolated from blood-cultures. The other bacillus had been under cultivation in the laboratory for several years.

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These six organisms were inoculated into a flask containing 100 c.c. of broth incubated from eighteen to twenty-four hours, and from this mixed growth agar-cultures were made. At the end of twenty-four hours the latter were washed off with sterile normal salt solution, and the bacilli were killed by holding the suspension at 58 C. for forty-five minutes. This was then preserved by adding 0.25 per cent. of tricresol. From the beginning of 1911 to the present time the vaccine has been prepared from a typhoid bacillus furnished us through the courtesy of Major Russell, this being the

TABLE 1.—DISTRIBUTION OF PERSONS INOCULATED FROM WHOM REPORTS HAVE BEEN OBTAINED

Springfield State Hospital, inoculated under the direction of Dr. J. Clement Clark, 1911	887
Spring Grove Hospital, inoculated under the direction of Dr. J. Percy Wade, 1911	664
Mercy Hospital, inoculated under the direction of Dr. Eckhart, 1910	68
Mercy Hospital, inoculated under the direction of Dr. Gillis, 1912	25
Franklin Square Hospital, inoculated under the direction of Dr. Pearce Kintzing, 1910	16
Franklin Square Hospital, inoculated under the direction of Dr. Pearce Kintzing, 1912	11
University Hospital, inoculated under the direction of Dr. H. J. Maldeis, 1911	88
University Hospital, inoculated under the direction of Dr. H. J. Maldeis, 1912	18
St. Joseph's Hospital, inoculated under the direction of Dr. E. H. Hayward, 1911	34
Homeopathic Hospital, inoculated under the direction of Dr. H. M. Stevenson, 1911	11
St. Agnes Hospital, inoculated under the direction of Dr. J. A. Chatard, 1911	38
Private cases, inoculated under the direction of numerous physicians, 1911-1912	44
Civilians (including physicians, nurses, students, etc.), inoculated by the authors, 1911-1912	140
	2.044

same avirulent strain with which the Army has been immunized. In the preparation of the vaccine from this bacillus it has been our custom to kill the organism by the use of 0.5 per cent. phenol (carbolic acid). In the main the various stocks of vaccine were standardized by Wright's method. Occasionally, however, Harrison's modification of this method was employed. Before dis-

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tribution the death of the typhoid bacillus and the freedom from contamination were determined by making aerobic and anaerobic cultures. As a further safeguard white mice and guinea-pigs were inoculated.

The injections were made subcutaneously into the arm near the insertion of the deltoid. At first the site of inoculation was prepared by rubbing briskly with 95 per cent. alcohol, but a little later a solution of phenol or mercuric chlorid was substituted for this. Since the summer of 1911 we have advised the thorough cleansing of the arm and the application of tincture of iodin round the point of insertion of the needle both before and after the inoculation.

The doses employed have been increased since we first started. We felt that if we were going to succeed in having antityphoid vaccine generally adopted by hospitals and institutions it was necessary at first to avoid any unduly severe reactions; we therefore began with the administration of 125 million, 250 million and 500 million dead typhoid bacilli at intervals of from seven to ten days. Later when this preventive measure became more firmly established in these institutions, we felt it was both safe and wise to increase the doses to 250 million, 500 million and 1,000 million bacilli, to be given at intervals of a week to ten days. We did not advise this, however, until these doses had been tried on students who had volunteered, and it was found that there was little or no perceptible increase in the severity of the reaction.

We have a record of the ages of 1,326 of those immunized: fourteen were in the second decade of life; 367 were in the third decade; 943 were in the fourth, and two were in the sixth. Of those between 10 and 20 years of age eleven were nurses in training, and eight of these gave a moderately severe reaction, certainly an inordinate number; the other three in the second decade were students, and these escaped without any systemic disturbance. There is no noticeable difference in the

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severity of the reaction to the vaccine for the other periods of life.

On analyzing the records we find that redness and local tenderness were present in all cases, but infection never ensued. Malaise followed the inoculation in 775 cases; headache in 835; muscular pains in 106; nausea and vomiting in sixty; chills in fifty-seven and rise of temperature in 884 cases. In 1,160, or 56.7 per cent., constitutional symptoms failed to follow the injections.

As already mentioned, 1,160, or 56.7 per cent., of those immunized did not develop fever. The temperature ranged from normal to 101 F. in 785, or 38.4 per cent., of the cases; from 101 F. to 103 F. in eighty-two, or 4 per cent.; and in the remaining seventeen, or 0.8 per cent., it exceeded 103 F.

TABLE 2.—STATEMENT OF INOCULATIONS WHICH WERE FOLLOWED BY CONSTITUTIONAL REACTIONS

Dose	Number of Records	Number Showing Systemic Reaction	Per Cent.
First alone	2,044	132	6.4
Second alone	2,044	255	12.4
Third alone	2,044	382	18.6
First and second	2,044	59	2.8
Second and third	2,044	14	0.6
First and third	2,044	10	0.4
First, second and third	2,044	22	1.0
Not noted	2,044	10	0.4

Of the 884 showing constitutional reaction 874 state the inoculation which this followed. The analysis of these 874 records discloses that the reaction occurred after the first injection only in 132 persons; after the second only in 255; after the third alone in 382; after the first and second in fifty-nine; the second and third in fourteen; the first and third in ten; and all three in twenty-two cases. From these figures Table 2 has been constructed.

Table 3 shows the percentage of reactions following each dose.

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In 246 of the 884 having a systemic reaction this lasted from one to six hours in fourteen cases; it persisted from six to twelve hours in ninety-six; it disappeared in from twelve to twenty-four hours in eighty-nine; from one to two days in forty-three; from two to three days in five; from three to four days in six instances; in five days in one; and it lasted over ten days in two persons. One of these, a female patient at Springfield Hospital, was suffering from chronic mania. In this case a low grade of temperature persisted for two weeks and pulmonary tuberculosis was suspected; and while no sputum could be obtained for examination for the tubercle bacillus, the patient had a dry, hacking

TABLE 3—PERCENTAGE OF REACTIONS FOLLOWING EACH DOSE

Dose	Number of Records	Number Showing Systemic Reaction	Per Cent.
First	2,044	223	10.9
Second	2,044	350	17.1
Third	2,044	428	20.9

cough and dulness over a portion of one lung. The other patient was an extremely hysterical woman. She suffered from gastric distress for ten days after the inoculation. She, however, has had similar attacks before and since that time. In another institution two tuberculous persons were vaccinated; one of these reacted with moderate severity, the other but very slightly.

Although the number of patients inoculated with the polyvalent vaccine has been comparatively small, we have drawn up a table comparing the reactions following the use of this with those resulting from the use of that prepared from the Russell strain. These are shown in Table 4.

This shows that in more than half the cases no reaction ensued after the use of either type of vaccine. In addition, we find that 95.8 per cent. of persons immu-

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nized with the single avirulent strain had either no elevation of temperature or a rise to less than 101 F., while but 80.7 per cent. of those receiving the other vaccine had a like result; moderately severe and severe reactions, therefore, more frequently occurred after the administration of the polyvalent type.

We feel, nevertheless, that no conclusions should be drawn from this comparative table, since they would be invalidated by the small number of persons that have been immunized with the polyvalent as compared with those protected with the monovalent vaccine. We believe,

TABLE 4.—COMPARISON OF REACTIONS FOLLOWING INOCULATIONS OF POLYVALENT VACCINE AND MONOVALENT VACCINE OF THE RUSSELL STRAIN

Reaction	Polyvalent Vaccine		Monovalent Vaccine	
	Number	Percentage	Number	Percentage
No reaction	56	56.5	1,104	56.7
Slight (temperature normal, 101 F.).....	24	24.2	761	39.1
Moderately severe (temperature 101-103 F.).	16	16.1	66	3.3
Severe (temperature over 103 F.).....	3	3.0	14	0.7

however, that one prepared from a number of strains of avirulent typhoid bacilli would subserve its purpose better than a vaccine made from a single strain. These organisms should be carefully selected; only those capable of producing large quantities of antibodies and at the same time not causing severe general disturbances should be used.

As already mentioned, we have increased the dosage of vaccine since the spring of 1911. In order to compare the reactions following the larger and smaller doses we have carefully gone over the reports received. The first inoculations with the increased doses were made into medical students, and as there was scarcely any increase in the severity of the reactions we have since then used them in the immunization of all adults.

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In making the comparison we have included only the cases of patients inoculated with the monovalent vaccine. This has been done because those injected with the other invariably received the smaller doses, and we therefore believe it is only fair to omit these altogether.

The examination of the records of those immunized with the single avirulent strain shows that 635 persons received 125 million, 250 million and 500 million, and 310 were given 250 million, 500 million and 1,000 million dead typhoid bacilli. Of the former 58.4 per cent. escaped without a general reaction; 39 per cent. had but a slight one; 1.8 per cent. suffered a moderately severe one; and 0.6 per cent. had a severe reaction. Of the latter 47.7 per cent. had no systemic symptoms; 39.3 per cent. reacted but slightly; 11.6 per cent. had a moderately severe, and 1.2 per cent. a severe reaction. Thus we find that 97.4 per cent. of those injected with the smaller doses showed either no constitutional disturbance or but a slight one, while only 87 per cent. of those receiving the larger quantities had a similar experience. Despite the somewhat larger proportion of moderately severe reactions we believe the use of the bigger doses is more than warranted by the greater protection that must almost certainly ensue.

Of the 310 injected with the larger amount 187 were nurses in hospitals, and it has been our experience that they show a disproportionate number of moderately severe and severe reactions. The fact, therefore, that so large a percentage of these cases was of this class explains to a great extent the differences noted above. Table 5 shows these differences in a striking manner.

As for more than two years antityphoid vaccine has been distributed by the conjoint laboratory of the state and city boards of health, we deem it important to tabulate the immunized cases according to the time that has since elapsed (Table 6).

Besides giving the length of time the various classes of people have been inoculated this table also shows that

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none of the immunized have developed typhoid. This latter fact is of peculiar interest when it is seen that the persons vaccinated have largely been those especially exposed to infection.

TABLE 5.—COMPARISON SHOWING GREATER REACTION IN NURSES

Dose	No Reaction		Slight Reaction		Moderate Reaction		Severe Reaction	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
125, 250 and 500 million	956	58.4	639	39.0	30	1.8	10	0.6
250, 500 and 1,000 million	148	47.7	122	39.3	36	11.6	4	1.2
125, 250 and 500 million (nurses alone).	3	7.9	30	79.9	3	7.9	2	5.2
250, 500 and 1,000 million (nurses alone)	68	36.3	89	47.6	26	13.9	4	2.1
125, 250 and 500 million (nurses excluded)	953	59.6	609	38.1	27	1.7	8	0.5
250, 500 and 1,000 million (nurses excluded)	80	65.0	33	26.8	10	8.1	0	0.0

TABLE 6.—CASES IMMUNIZED SINCE VACCINE HAS BEEN DISTRIBUTED

	Hospital Nurses and Attendants	Inmates Public Institutions	Civilians	Total	Typhoid Among Immunized
2-2½ years ..	84	0	15	99	0
1-1½ years ..	0	0	56	56	0
1 year	171	887	36	1,094	0
9 mos.-1 yr...	0	330	0	330	0
6-9 months...	0	334	18	352	0
3-6 months...	11	0	55	66	0
1-3 months...	43	0	4	47	0
Total.....	309	1,551	184	2,044	0

Thus, 309 were nurses and attendants in general hospitals in a city in which typhoid is very prevalent. Now Joslin and Overlander[3] found that the attack-rate for nurses in six Boston hospitals for the years 1902 to

3. Joslin and Overlander: Boston Med. and Surg. Jour., civil, 247.

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1905 was 161 per 10,000 as compared with twenty per 10,000, which was approximately the morbidity for the whole of Massachusetts. Again, as previously noted by Hachtel and Stoner,[4] for the five years preceding the adoption of this prophylactic measure the attack-rate for nurses and attendants in six Baltimore hospitals was about 500 per 10,000. Since in the city at large the number of cases for the same years has ranged from 24.5 to 42.2 per 10,000 inhabitants;[5] therefore, in these hospitals the nurses and attendants appear to be about twelve to twenty times as liable to infection with enteric fever as the citizens of Baltimore. As before stated, the attack-rate before immunization was instituted was 5 per cent., while that for vaccinated nurses and attendants has been *nil*. Add to this that in five of these same institutions eighty-two nurses were not injected, and seven of these, or 8.5 per cent., contracted typhoid, and we have a most striking comparison.

Then again, 887 of the vaccinated were inmates and employees of an institution for the insane, principally the former. In this asylum the morbidity from enteric fever for the previous years was 1 per cent. a year. Now while not one of the inoculated developed this disease, three out of 333 not immunized suffered from typhoid.

Still further, the 184 civilians were persons particularly subjected to infection, such as physicians, nurses in private practice, laboratory workers, medical students and traveling salesmen. Besides this, eleven of these were members of infected households, and in several instances either nursed or assisted in the nursing of the patient.

In conclusion, we are convinced that antityphoid vaccination is of incalculable value in the protection against enteric fever, and owing to the undue incidence of this disease in hospital nurses and attendants, they should

4. Hachtel and Stoner: Am. Jour. Pub. Health, ii, No. 3, p. 157.
5. As the report of typhoid cases in Baltimore is not complete, these figures are estimated from the reported deaths on a basis of a 10 per cent. fatality.

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be urged to submit to inoculation. Indeed, we feel that the authorities in control of such institutions who do not offer their nurses this protective measure are negligent in the extreme. In public institutions, especially in hospitals for the insane and mentally deficient, inoculation should be employed in reducing the number of cases of this malady. In the latter hospitals great care should be exercised as to the selection of patients for immunization, avoiding those of advanced years and those suffering from chronic organic disturbances such as arteriosclerosis and cardiac and renal diseases.

Considering the brilliant results obtained, the very slight inconvenience usually experienced following the vaccination, the atrocious number of cases of typhoid fever occurring yearly in both the city and the country, and the extreme complexity of the problem of lessening this attack-rate by sanitation, it is our firm conviction that all civilians should be advised to be inoculated against this disease. Naturally we do not advise antityphoid vaccination as a substitute for proper sanitary control. When we think of the extreme difficulty of coping with typhoid, however, and the length of time it will require to attain the ideal of sanitation; when we consider that even under the best sanitary conditions we still have to fear the typhoid carrier, direct contact and the danger of introduction from without by visitors and by citizens, we believe that antityphoid inoculation will have a place in the prevention of this disease in civil life, and that boards of health should not only advise the adoption of this measure, but should also distribute the vaccine free of charge for the immunization of the citizens of their respective communities.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. SPOONER, RUSSELL AND HACHTEL AND STONER

DR. M. P. RAVENEL, Madison, Wis.: The State Hygienic Laboratory of Wisconsin began issuing antityphoid vaccine free of charge to physicians of the state about nine months

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ago. Our experience is that inoculation into the arm as recommended in the Army produces less reaction than in other parts of the body. I wish to confirm what Dr. Spooner has said about the mildness of the attack in those who have been partially vaccinated or in whom infection has already taken place when the vaccination was done. We have had several cases which confirm this statement. We have urged strongly the vaccination of nurses in hospitals throughout Wisconsin and it is being done to a considerable extent. The following case is of interest: A woman was suffering from typhoid fever. The attending physician wished to vaccinate the husband and two trained nurses in charge. We sent the vaccine. One nurse, however, refused the vaccination, saying that she was immune. Soon after leaving the case she was taken sick with typhoid. The husband and the other nurse remained well.

We have vaccinated about 1,900 people in Wisconsin, including approximately 1,000 of the National Guard. The reactions have been almost invariably mild. Two severe reactions occurred on the third injection which were hard to explain. Inquiries showed that both men had been drinking. Our experience, though comparatively small, has convinced us of the great value of the process. In one institution we apparently stopped a bad outbreak at once. In a small town where typhoid was raging we vaccinated 116 persons. We have not had the report of a single case occurring in any of those vaccinated. We are using a polyvalent vaccine, and are urging on the physicians of the state the further adoption of the practice.

Dr. Malcolm C. Rose, New York: It is a great thing when a physician can say that he has had this preventive treatment himself; perhaps Major Russell and Dr. Spooner have had it; I would like to know their personal experience and learn just how it feels, because the next trip of the American Medical Association will probably be away to the West—we shall have to travel on cars, boats and other means of transportation where we shall be exposed. Dr. Spooner speaks about the severe reaction; but exactly what he saw I am not quite sure. Then, also, how long does this immunization last?

Does vaccination help to prevent relapse when a typhoid patient is vaccinated in the home? Does it help to prevent relapse, or what some doctors call a relapse, when it is a new running of the disease? I call a relapse the result of improper care or improper feeding.

Dr. Lesley H. Spooner, Boston: I have not used the interscapular region for a long time. I have inoculated only 500 in the back; but I have been impressed by the fact that the circumference of induration was not so great nor complaints so frequent as when other regions were employed. There is

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one thing to be said, however, in limitation of that statement: those persons who have been inoculated in the back have been chiefly private patients. I find that in the latter class less severe reactions are met than among nurses and physicians. This may account for the discrepancy in our findings.

An episode connected with the little epidemic which I have described before parallels Dr. Ravenel's experience of similar exposure to the two nurses engaged on the same case. Two table girls were employed at the hotel which was the hotbed of this epidemic, since about half the cases originated there. These girls were doing exactly the same work; they shared the same room and slept in the same bed. One was inoculated, the other was not. The former had the most severe reaction of any one in that group of cases. She did not contract the disease. Two weeks after the last inoculation, the uninoculated table girl contracted the disease. In regard to personal inconvenience, I will say that I inoculated myself twice and was given the third injection by a confrère three years ago. On only one occasion did I feel any constitutional reaction. It consisted of such symptoms as one expects on the eve of a cold. The following day they had entirely disappeared. There was, as I recall, slight local soreness. I felt nothing to prejudice one the least against undergoing the treatment.

Dr. F. F. Russell, Washington, D. C.: Since we do not know accurately the duration of the immunity, we recommend revaccination of soldiers once in each enlistment, giving two doses on the second vaccination, rather than three. Among civilians we suggest revaccination only on exposure. It is important to refuse vaccination of persons who are not well. Our refusal to vaccinate all but the healthy may explain our good results and complete lack of accidental complications. Many are using polyvalent vaccines with the idea that they are better than vaccines made from a single strain of the bacillus. We have always used a single, selected strain, which confers protection wherever used. There is more reason for adding a little paratyphoid to the vaccine. At present we do not know how prevalent paratyphoid fever is; we are encouraging our men to use blood-culture methods, that this point may be accurately known.

The importance of Dr. Spooner's work in the Greensboro epidemic and of vaccinating the nurses while on duty in the hospital is great. It is a different problem from ours. At Torrington, Conn., last summer, vaccine was used extensively in an epidemic; there was only one case among the vaccinated, and that a mild one. I do not remember the total number of cases, but eighty nurses were employed, of whom forty-five accepted and thirty-five refused vaccination. Among the forty-five there were no cases, while three occurred among the thirty-five unvaccinated. Vaccine was used in a small epidemic

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among 2,500 marines at Guantanamo, Cuba. In the one case in which typhoid developed after vaccination, autopsy showed that the patient was undoubtedly infected before. Wright and Leishman used vaccine during the height of an epidemic at Maidstone, England, with excellent results. Cullison, a pupil of Wright, vaccinated the attendants and nurses of an insane asylum in Dublin, during an epidemic, with the same good results. The vaccine was used the past year in an epidemic in Cedar Rapids, Iowa, where the outcome was also satisfactory. Dr. Spooner's paper again emphasizes the fact that we need have no fear of an injurious negative phase; that we can safely vaccinate against typhoid as we do against small-pox.

It seems probable that the way in which the vaccination is done has something to do with the severity of the reaction. The absorption of vaccine should be as slow as possible. We think it should be put into the subcutaneous tissue, and not into the muscle; some men have vaccinated directly into the muscle, where the absorption is too rapid, producing a decided reaction. If the second or third dose is injected into a region still indurated from a previous inoculation there may be rapid absorption, with severe reaction.

DR. HARRY W. STONER, Baltimore: Several striking instances occurred in our experience with the vaccine: In one institution eighty-eight out of ninety-one nurses and attendants were inoculated in 1911. One of the three nurses not inoculated developed typhoid fever and died. At another hospital a nurse who was on her vacation at the time the inoculations were made was not immunized. A few weeks after she returned to the hospital she developed typhoid. In still another institution in which the nurses were immunized in 1910, three out of eight new nurses who came in in 1911, and who had not received the vaccine, were stricken with typhoid fever during the latter part of that year, while none of the inoculated nurses remaining in the hospital were attacked.

The question how long immunity lasts is a pertinent one and not easily answered. From studies we have made with the serum of rabbits inoculated with typhoid vaccine, we have found a gradual rise in the bacteriotropic substances—bacteriolysins, agglutinins and opsonins—corresponding closely, and following about the same curve as that occurring in human beings. These substances were demonstrable in the blood for from six months to a year, gradually decreasing until they finally disappeared. When these animals were reinoculated with similar doses of the same vaccine it was found that there was a much quicker production of these substances than at first. We believe that the first inoculation sensitized certain cells, which on reinoculation responded more readily to the production of these substances, and that a person immunized by typhoid vaccine is protected from typhoid by the rapid

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formation of these antibodies. Since the curve of the formation and duration of these bacteriotropic substances in the blood of immunized individuals corresponds closely with their production and durations in the blood of patients with typhoid fever, it would seem that an immunized individual would be as well protected as is the individual who has had typhoid fever.

As to personal experience, Dr. Hachtel and myself were the first in our series of cases to receive the vaccine. Neither of us suffered any great reaction. Following the second injection I had a slight rise in temperature and a dull headache lasting about two hours. The other two injections did not give rise to any symptoms.

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THE RELATION OF INTERSTATE WATERS TO THE SPREAD OF TYPHOID

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Interstate waters are the source of water-supply for many millions of people. The number actually dependent on interstate or international sources is constantly growing. Sanitary conditions in the drainage area of the Great Lakes and the drainage basins of the Missouri, the Mississippi, the Ohio and other great rivers are becoming more important because of the increasing demands on these waters as sources of public supply. With the increase of population especially in sewered cities there is a coincident increase in direct sewage pollution of these waters. It has been the common practice in American cities to use these interstate waters for sewage disposal. This method of sewage disposal by dilution has an enormous advantage because of low cost over other methods involving more or less purification. In so far as nuisance is concerned, there was usually stream flow or volume of water sufficient to ensure proper dilution. No criticism can be made of cities which employ this method for economic reasons provided they furnish proper safeguards to their own public water-supply and that they do not pollute or endanger the supply of other cities. Unfortunately until recently nearly all cities situated on these great waterways furnished water without filtration or treatement and at the same time discharged their unpurified sewage into the same interstate water. In the case of lake cities the water-works intakes often received contamination from

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their own sewage, while the cities on the great rivers furnished pollution for the intakes of other cities situated down-stream.

Under these conditions it is not strange that very high typhoid fever rates prevailed in these cities and that from time to time massive explosive outbreaks occurred.

A glance at the accompanying tables will show the excessive prevalence of typhoid fever in these cities compared with cities in northern Europe.

TABLE 1.—ANNUAL DEATH-RATES FROM TYPHOID FEVER PER HUNDRED THOUSAND POPULATION IN SOME LARGE AMERICAN CITIES ON THE GREAT LAKES AND THE MISSOURI, MISSISSIPPI AND OHIO RIVERS

City	1906	1907	1908	1909	1910
Chicago	18.3	17.7	15.3	12.6	13.7
Indianapolis	39.2	29.4	26.4	22.3	28.5
Louisville, Ky.	67.7	67.9	44.2	45.0	31.7
New Orleans	29.6	55.5	33.1	28.4	31.5
Detroit	22.3	28.3	22.3	20.5	23.0
Grand Rapids, Mich.	39.1	32.4	31.8	17.2	28.3
St. Paul	21.1	17.1	12.0	18.9	19.5
Minneapolis	32.9	25.9	17.8	21.0	58.7
Kansas City, Mo.	37.8	39.9	35.0	29.3	54.4
St. Louis	11.9	14.1	13.0	16.2	14.9
Omaha	28.2	23.5	22.1	36.8	86.7
Buffalo	23.6	29.2	20.7	23.8	20.4
Cincinnati	71.5	46.4	18.6	13.3	8.8
Cleveland	20.2	18.9	12.6	13.3	17.9
Columbus, Ohio	37.1	38.3	110.5	19.6	18.1
Toledo, Ohio	45.0	36.4	40.1	41.7	37.2
Pittsburgh	141 3	130.8	46.6	24.6	27.8
Memphis, Tenn.	42.4	38.8	37.0	48.8	27.4
Nashville, Tenn.	74.4	82.6	59.5	52.0	48.9
Milwaukee, Wis.	30.5	25.7	17.4	21.4	45.7

For many years there seemed to be a general understanding that sewage must be kept away from the public water-supply. It might be discharged into the same body of water provided the point of discharge was "down-stream" from the intake. In river cities this principle disregarded the rights of the communities situated down-stream, and their intakes were thus exposed to pollution. In cities on the Great Lakes the curious fallacy was prevalent that there was a normal lake current setting consistently in one direction and

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that if the intake were placed "down-stream" in relation to this current it would be safe from sewage pollution. Thus in Lake Erie the current was supposed to be from west to east, and the intakes were invariably placed to the westward of the sewage outlets.

Another instance of the insecure measure of protection which formerly seemed to satisfy public demand in preventing pollution of intakes is furnished by the

TABLE 2.—ANNUAL DEATH-RATES FROM TYPHOID FEVER PER HUNDRED THOUSAND POPULATION IN TEN EUROPEAN CITIES

	Average for 5 Years, 1901-1905	1906	1907	1908	1909	1910
Stockholm	3	2	2	1	0.5	1.8
Christiania ...	3	4	2	2	1.7	1.6
Munich	4	2	3	3	1.9	1.4
Edinburgh	8	3	3	2	1.2	1.3
Vienna	4	5	3	4	2.8	3.8
Hamburg	4	4	3	4	3.3	4.1
Berlin	4	4	4	4	4.2	2.9
Dresden	4	7	2	6	4.2	2.2
Copenhagen ...	8	4	2	7	2.7	3.6
London	8	6	4	5	2.2	3.3

Niagara River cities. Buffalo, the Tonawandas, Lockport and Niagara Falls all have intakes which were supposed to be safe because the sewage-polluted current hugged the shore in a ribbon ordinarily about 300 feet wide, and the intakes were placed from 700 to 1,500 feet from shore to avoid this polluted shore water.

We know now from bitter experience that currents on the Great Lakes are notoriously unstable and cannot be expected to protect water-works intakes for more than a portion of the year. We know also that the width of polluted shore water is variable and inconstant, and cannot be depended on except in quiet weather.

Some of our big progressive cities spent large sums of money to escape the sewage pollution by extending the intakes further out into the lake and by diverting sewage from the source of water-supply. These measures afforded but temporary relief and merely postponed the

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inevitable treatment or filtration of the public water-supply. The obvious remedy — water purification — which gives prompt protection, seems to have been reached last and in nearly every instance was applied only after other expedients had failed.

STORAGE AS A PURIFYING AGENT

The storage capacity of the Great Lakes is enormous. Let us take Lake Michigan as an example. Lake Michigan is 307 miles long and has a maximum width of about 118 miles. The maximum depth is 870 feet.

TABLE 3.—ANNUAL DEATH-RATES FROM TYPHOID FEVER PER HUNDRED THOUSAND POPULATION IN FIFTEEN OTHER EUROPEAN CITIES

City	1909	1910
Frankfort	1.5	0.9
Antwerp	1.0	2.3
Bristol	2.8	2.1
Nuremberg	2.6	...
Birmingham	5.0	3.9
Belfast	5.2	3.9
Lyon	5.8	4.4
Leeds	7.2	3.8
Liverpool	8.4	3.9
Sheffield	9.4	3.0
Rotterdam	6.4	6.5
Amsterdam	3.8	6.7
Paris	8.4	5.6
Bradford	4.3	9.2
Leipsic	8.3	7.5
Total average rate...	5.3	4.5

With this storage capacity its power to oxidize and purify organic matter can scarcely be overestimated. The effect of storage of Lake Michigan water is accentuated by the comparatively small outflow (an average of only 57,000 cubic feet per second through the straits of Mackinac). For example, compared with Lake Huron, the area of water surface is nearly the same (over 22,000 square miles) and the maximum depth of Lake Michigan is about 100 feet greater than that of Lake Huron. The outflow of Lake Huron at Port Huron is about 210,000 cubic feet per second while the outflow from Lake Michigan is only about one-fourth as much. This

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means longer retention of polluted inflow from rivers and sewers and more opportunity for purification before discharge through the straits at Mackinac. It would take Lake Michigan many years to empty itself at its present rate of outflow if all inflow were prevented. Under these circumstances the quality of Lake Michigan water must be good provided we can get it far enough from the polluting inflow of rivers and sewers. Unfortunately the zone of polluted water extends a considerable distance out into the lake from the water-fronts of the cities and the mouths of the large rivers; further,

TABLE 4.—TYPHOID FEVER RATES IN LARGE EUROPEAN AND AMERICAN CITIES

Unit of Comparison	Aggregate Population	Deaths per 100,000 from Typhoid Fever, 1910
Thirty-three principal European cities in Russia, Sweden, Norway, Austria-Hungary, Germany, Denmark, France, Belgium, Holland, England, Scotland and Ireland	31,500,000	6.5
Fifty American cities of 100,000 inhabitants or over	20,250,000	25.0
Excess of deaths from typhoid fever in American cities	.....	18.5

this zone of pollution has no constant boundaries because of currents due to wind and flood, but threatens under unusual weather conditions far beyond the point which seems safe in quiet weather.

These facts make it extremely difficult if not impossible both from the engineering and the economic points of view to obtain pure water near our large lake cities every day in the year by simply extending a pipe out into the lake without filtration or treatment of the water.

When cities have a public water-supply polluted by sewage, or admittedly exposed to pollution, the obvious thing to do is to filter or treat the water and protect the public from infection. Unfortunately there is a deplorable tendency to abuse the town upstream and to spend

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years in an effort to compel (usually without legal process) sewage treatment in the offending municipality. In other cities where the pollution is due to their own sewage, years are lost in the discussion of methods of sewage purification, while the dangerous untreated and unfiltered water is furnished to the citizens.

In regard to sewage disposal, it must be remembered that no general rule can be formulated which will cover with justice every case. Each municipality becomes a separate problem and local conditions must be studied. Remedies for correction of improper sewage disposal will differ according to the local conditions. Even if all the sewage from our large cities and towns was prevented from reaching the lakes and rivers, it would be impossible to prevent pollution from reaching these waterways in times of storm and flood, so that sewage disposal even carried to the degree of sterilizing the effluent does not give us a substitute for water filtration or treatment. While it is impracticable to prevent pollution of the Great Lakes and other interstate waters, it is possible and imperatively necessary that such pollution be controlled and kept within safe bounds. It would be very foolish from an economic standpoint not to avail ourselves of the cheapest and simplest method of sewage disposal, namely, disposal by dilution, provided that this may be done without danger to the water-supplies of other communities and without putting an unreasonable burden and excessive responsibility on the filter-plants of those communities. The point to which this method of disposal may be permitted must be determined by local conditions.

Disaster occurs from using sewage-polluted water-supplies for one of three reasons: (1) failure to purify; (2) inefficient purification; (3) failure to supply the purified water to all.

The failure to instal a purification plant is usually due to an undue confidence in a water-supply which is safe "most of the time." It is difficult for some to

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understand, without a severe lesson, that it is not sufficient to have a water-supply that is safe for 360 or 361 days in the year, and to these officials it seems scarcely justifiable to require expensive purification for the sake of the four or five days in the year during which, due to weather conditions, pollution may take place. Such a supply, with a favorably placed intake, may escape pollution for more than a year. There was no evidence of serious pollution of the water-supply of the city of Erie during the year 1909, yet the appalling disaster of January and February, 1911, showed that pollution could take place under certain weather conditions.

One large city using unfiltered lake water is so sure that the water is pure that examination is made only occasionally. One of the largest lake cities using an unfiltered supply exposed to sewage pollution makes a bacterial count daily, but restricts its effort to detect sewage pollution to the antiquated and indefinite test of inoculating a guinea-pig occasionally with a small portion of a broth culture.

Poor filter efficiency is often responsible for disaster in the shape of typhoid outbreaks and may be due to several causes. The slow sand type may give poor filter efficiency when sufficient extra units are lacking, necessitating excessive rates and placing of "green" filters in service. Excessive rates, too little coagulant, insufficient capacity of sedimentation tanks and insufficient storage are common operating and structural faults of the mechanical type. Sometimes a properly constructed plant is struggling with a raw water which has a high bacterial content and even with fair filter efficiency yields an unsafe effluent. Probably the greatest single cause of a poor effluent from filter-plants is inefficient operation by unskilled men. It is absolutely essential for good results that bacteriologic examination, including *Bacillus coli* estimation, be made at least once daily, and in slow sand plants from each unit separately.

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The man in charge must be able to do this. In mechanical filter-plants or with hypochlorite plants he must also have the necessary skill to adjust his chemicals with nicety according to the changes in the raw water. With such a man in charge of a properly constructed plant a safe effluent is assured at all times. When struggling with a bad raw water, he will use hypochlorite as an adjuvant with good results. He will study the peculiarities and fluctuations of the constituents of the raw water and adjust his treatment accordingly.

The most serious defect in sanitary control of our water-supplies is the lack of proper daily bacteriologic examination of the water and quantitative estimation of the *B. coli* content. In some of the lake cities there is proper daily bacteriologic examination of the water-supply, but in many of them there is either an imperfect examination or none at all. One city with a slow sand filter-plant of three units and a consumption equal to the safe filter capacity of the beds operates these without rest, putting the units in service "green" and with an occasional examination of the water once or twice a month. As a result this city in 1910 had a typhoid fever death-rate of over 300 per hundred thousand.

As an instance of high rate due to failure to furnish filtered water to all the people, the experience of Pittsburgh is interesting. The filter-plant in Pittsburgh was first put in operation November, 1907. But a small portion of filtered water was supplied at first and this was mixed with the unfiltered supply. The amount of water filtered was increased until October, 1908, when the supply of that part of the city between the rivers — about three-fifths of the total population — was filtered.

The south side, a little less than one-fifth of the entire population, was supplied with filtered water in March, 1909. The former city of Allegheny, recently annexed, is not yet supplied with filtered water. This part of the city includes a population of about one-fourth of the entire city.

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There was a remarkable decrease of typhoid fever in Pittsburgh progressively coincident with the increase of area supplied with filtered water. In spite of all this remarkable reduction two points stand out prominently: First, the rate is still high (1910), and second, the seasonal distribution suggests water as a prime factor. Explanation of these two points is furnished by a study of the cases as shown in Table 5, from which it is clear that water was responsible for the high rate, and that this high rate was due entirely to the abnormal rate in Wards 21 to 27 inclusive.

TABLE 5.—TYPHOID FEVER DEATHS BY WARDS, PITTSBURGH, 1910 *

Ward	Population	Typhoid Deaths	Ward	Population	Typhoid Deaths
1	11,623	3	15	20,141	3
2	14,386	1	16	20,833	1
3	26,462	3	17	25,213	3
4	25,055	11	18	17,994	1
5	24,495	2	19	23,482	3
6	26,261	3	20	18,648	2
7	13,263	1	21	22,506	11
8	18,204	0	22	15,716	9
9	17,795	6	23	21,799	13
10	21,205	3	24	17,354	6
11	17,066	2	25	16,037	5
12	22,342	2	26	15,291	6
13	24,080	2	27	15,291	6
14	13,074	1			

* These figures were furnished by the health department of the city of Pittsburgh.

Total population of Pittsburgh	533,905
Total deaths, typhoid fever	115
Death-rate per 100,000, entire city	21.3
Death-rate per 100,000, Wards 1 to 20	13.4
Death-rate per 100,000, Wards 21 to 27	46.9

Wards 1 to 20 were supplied with filtered water. The aggregate population of these twenty wards was 401,622. The typhoid death-rate per one hundred thousand in 1910 was 13.4. Wards 21 to 27 comprise the old city of Allegheny and have a total population of 132,283. This section received unfiltered water. The typhoid death-rate per one hundred thousand in this section in 1910 was 46.9.

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THE SIGNIFICANCE OF TYPHOID FEVER FROM AN INTERSTATE STANDPOINT

The spread of typhoid fever from one state to another is a national problem and to prevent this spread it is necessary to reduce the prevalence of typhoid fever in cities and states, so that at once it is a national problem and a local or state problem as well. The careless pollution by sewage in one state by A, of a stream used as a water-supply without filtration in another state by B, is an illustration of interstate spread of typhoid fever which is common enough. In such an instance A, the town polluting the stream, insists that B, the town below, protect itself by filtering its water-supply; B insists that A, the town above, should render its sewage innocuous before discharge into the stream. As a matter of fact both may be right and both of these two great agencies for preventing water-borne typhoid may be necessary. It is difficult for these warring communities to adjust their differences and decide just to what point sewage purification must be carried at A, in order that too great a strain and too great a responsibility may not be placed on the filter-plant at B. The significance of polluted water-supplies in large industrial centers from an interstate point of view is enormous. Trains and steamboats take their water-supplies at such points and this polluted water is drunk by the passengers throughout the trip.

Excessive prevalence of typhoid fever in any city which by reason of its commercial or industrial importance attracts large numbers of visitors has an important bearing on the spread of typhoid from one state to another. The same is true of other cities which because of great natural advantages, the beauty of their surroundings or other reasons attract thousands of tourists and visitors from other states. For these reasons, the prevalence of typhoid and the character of the water-supply in cities like Pittsburgh and Detroit, Niagara Falls or Mackinac Island becomes a matter of serious

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moment from an interstate point of view. The excessive prevalence of typhoid fever for years in Niagara Falls and Pittsburgh was not only a matter of local or even state concern, but a grave national danger as well.

Great reduction in the typhoid fever rate has been effected recently by the installation of filter-plants in Pittsburgh, Philadelphia, Cincinnati, Columbus, Ohio, and Escanaba, Mich.[1] Hypochlorite treatment of the water has produced remarkable results in lowering the typhoid fever rate in Erie, Pa., Omaha and Minneapolis. In spite of these encouraging results in certain cities, much remains to be done in cities which are still using unpurified surface water for public supplies.

The problem of sewage pollution of interstate waters with special reference to the spread of typhoid fever has been studied intensively by me for the past eighteen months. During that time my investigations have covered the entire drainage area of the Great Lakes within the United States from Duluth, Minn., to Ogdensburg, N. Y.[2] As a result of this study certain fundamental facts seem to stand out prominently in the discussion of this problem:

1. The primary necessity from a sanitary point of view is safe water-supplies 365 days in the year without waiting for solution of sewage-disposal problems.

2. In spite of the most elaborate methods of sewage purification, pollution of these waterways will take place at certain times, so that sewage purification cannot be considered a substitute for the inevitable purification of water.

3. Because of winds and currents, floods and thaws, the boundaries of the zone of shore pollution are constantly changing. The only way to secure safe water every day in the year, without unjustifiable expense, is by some method of water purification.

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1. Hyg. Lab. Bull. 83.
2. McLaughlin, Allan J.: Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever, Hyg. Lab. Bulls. 77 and 83.

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4. Sewage purification may often be an aid and sometimes a necessity to improve the quality of the raw water, but will rarely, if ever, make one of these surface supplies absolutely safe. For this reason it must be considered as secondary to water purification in preventing water-borne diseases.

5. The use of streams for sewage disposal within permissible bounds is an economic advantage, and absolute prohibition of this use is unjustifiable.

6. This use of streams is sound in principle and safe in practice when proper restrictive control is exercised.

7. The permissible limit of pollution of each river, lake or waterway can be fixed only by careful study of the waterway, and of the uses which must be made of it and to which it is best adapted.

8. Although prevention of all pollution is impossible, control of pollution is feasible and imperatively necessary. The absolute prohibition of discharge of sewage into these waters is scarcely justifiable and the legality of such legislation would be extremely doubtful.

9. The discharge of sewage should be under control and permitted when possible for economic reasons within certain limits. The permissible limit of such reasonable use should be fixed by official standards of the raw water after a careful sanitary survey and consideration of the purposes for which the waterway is necessary or available.

10. These official standards would have to be made for each problem separately and independently, it being manifestly impossible to attempt to fix any general standards of raw water to cover all cases. The acceptance of these basic facts will tend to prevent unjustifiable generalization in a problem in which each city is a law unto itself. By allowing a reasonable use of these interstate waters in the reception of sewage or sewage effluents subject to such restrictions coupled with water purification which will amply protect the public health,

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the more intensive processes of sewage purification may in many cases be avoided. A city may thus be saved a very great expense which could only be justified on sentimental and not on practical grounds.

To attempt the impossible is not only to court certain failure, but further, such attempts make difficult later efforts of a more conservative and practical nature.

ABSTRACT OF DISCUSSION

DR. H. M. BRACKEN, Minneapolis: Some people argue that the purification of sewage should be required to such an extent as to leave the streams into which it is discharged fit for drinking purposes. On the other hand, some engineers go to the other extreme at present, if I understand their position, maintaining that streams are natural sewers, and that they should be used as such, even to the point of creating a nuisance. I think it will have to be admitted that streams must be used for the carriage of sewage; but partial purification of the sewage before its discharge into streams should also be insisted on, so as to make the filtration of the water for domestic use less burdensome.

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BOOKS AS CARRIERS OF SCARLET FEVER INFECTION

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VALPARAISO, IND.

Scarlet fever made its appearance in Valparaiso, Ind., September, 1908, and continued until June, 1911. It is estimated that during this time there were 400 cases, of which only 255 were reported to the city board of health, 145 were not reported and most of them were not subjected to quarantine regulations. Beginning in February, 1911, a special study of the epidemic was begun to determine, if possible, what steps were necessary to terminate this epidemic.

The question whether the infection was being spread through the medium of books was considered. If books were carriers of scarlet fever infection, the opportunity for the spread of the disease in this city by them was very great, as Valparaiso is a residence and school city with about 10,000 population. It supports two libraries, one a public city library, the other a public library in connection with the Valparaiso University. The libraries were both extensively used, the public library by the public school children, the citizens and the university students. The university library was used largely by the university students. Two bookstores situated near the university made a practice of renting text-books used at the university; two department stores in the city were maintaining circulating libraries, and

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in the lower grades of the public schools a large number of supplemental books were furnished the pupils by the school authorities and these books were passed from class to class. This showed the importance of determining whether books were mediums of the spread of the disease or not, and if so what was the practical method for rendering them harmless. To determine the part books played in the spread of scarlet fever in this epidemic an investigation was begun of the books in the city library, as this was the only place where sufficient records were kept to enable us to make a fair investigation, the scope of which included the following points:

1. The connection existing between the public library, the reading-rooms, the condition of books and the management of the library with reference to the spread of scarlet fever.

2. To ascertain what precautions were taken by the librarians to prevent the books from becoming the carriers of disease.

3. To determine if library books were responsible for any of the cases of scarlet fever in the city at this time.

4. To ascertain if books which had been in homes during or immediately after scarlet fever, when neither the houses nor books had been fumigated, have acted as carriers of the disease.

5. To determine whether books which had been burned were probably responsible for the cases of scarlet fever which occurred while the books were in the homes.

THE INVESTIGATION

1. The Library.—The building is an old brick dwelling-house which has been converted into a library building. The juvenile reading-room is well lighted and well ventilated; the other rooms are crowded and have poor lighting, but good ventilation facilities; the floors and furniture are kept free from dust, the books are kept in open cases or on unprotected shelves and are as

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free from dust as they could be kept under the present condition of the building and furnishing. At frequent intervals the rooms have been fumigated with formaldehyd gas; the heating is by steam; sweeping is by brush, and "dust-down" is used. The books are in good repair and not badly soiled; the juvenile department is very popular, having had 1,000 borrowers who used over 10,000 books in 1910; this department had an attendance of 4,351 that year. Nearly 9,000 books were used by adults; the adult attendance was 7,000. The library contains about 9,000 volumes. Nearly 20,000 books were made use of last year. A splendid system was installed May, 1910, for keeping a record of all borrowers, and by it the librarian, if given the title of any suspected book, was able to give the name and address of the borrower and date due for return of book.

The popularity of the juvenile department and the attendance of children suffering from a mild attack of scarlet fever, or those who had been too early released from quarantine, undoubtedly was a source of direct contact, and doubtless some cases resulted; yet no specific case was traced to the library. The management is alert and desirous of making the library a perfectly safe and sanitary place.

2. Precautions Taken to Prevent Books From Becoming Carriers.—The principal precaution taken to prevent books from becoming carriers of disease consists in the enforcement of a rule that all books in a home, when a contagious disease develops, shall be burned. Whenever the librarian was notified that a borrower who had a book had scarlet fever, or that scarlet fever was in the house occupied by a borrower, she would notify the borrower to burn the book, and on release from quarantine to call and give particulars concerning its destruction; or, if it was returned the librarian would attend to the cremation. Notification of scarlet

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fever did not always reach the librarian for two principal reasons:

1. The board of health is not obliged to notify and in many instances did not notify the librarian of cases reported.

2. Many cases of scarlet fever had existed without being reported to the board of health and have escaped being subjected to quarantine regulations and the public library regulations also.

No special fumigation of books is practiced. Soiled books are washed with gasoline. The books are in good repair. Those on the shelves and in the cases are somewhat fumigated by formaldehyd when the rooms are fumigated. At frequent intervals the worn and soiled books are cleaned and rebound. In the future, the secretary of the city board of health should notify the librarian of all cases of contagious diseases when any danger of book contamination is possible.

3. *Responsibility of Public Books for the Spread of Disease.*—To determine if public library books were responsible for any case of scarlet fever in the city, during the time of this investigation, whenever a case of scarlet fever developed an inquiry was made whether any member of the family or any occupant of the house, at any time or just preceding, had had a public library book, and if so, the name of the book. The librarian was then asked to furnish a history of the book; for example, John F. developed scarlet fever March 4, 1911. His sister, Jeanette F., had just returned a certain book to the library. The librarian's record of this book showed it to have been in seventeen homes between April 3, 1910, and the date that Jeanette F. returned it to the library, March 9, 1911. The librarian's record with a statement whether the borrower had had scarlet fever or not, with the date of the disease, when this could be obtained, was as follows:

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LIBRARIAN'S RECORD OF THE BOOK TAKEN BY JEANETTE F.

Name of Borrower.	Book Taken.	Had Scarlet Fever.*	Date of Disease.
Margaret B.	4/19/10	+	11/—/09
Pearl O.	6/ 1/10	—	.....
Ella G.	6/17/10	+	5/—/10
(This was known to be a short quarantine, making this a suspicious book.)			
William H.	8/ 1/10	—	.....
Helen H.	9/ 6/10	—	.....
Ivan C.	10/ 3/10	+	6/15/09
Martha B.	10/16/10	—	.....
Gladys V.	10/23/10	—	.....
Margaret D.	11 /3/10	—	.....
Geneva H.	11/ 4/10	+	7/—/10
Helen N.	11/11/10	+	—/—/98
Martin A.	11/22/10	+	4/—/09
Richard M.	12/12/10	—	.....
Bruce B.	1/ 3/11	—	.....
Harry G.	1/12/11	+	10/—/09
Eda L.	2/ 4/11	+	10/—/09
Jeanette F.	2/23/11	—	.....

* The plus sign (+) indicates that the borrower had scarlet fever and the minus sign (—) that the borrower did not have scarlet fever.

Jeanette F.'s brother developed the disease March 4, 1911, and as he was an attendant in the first grade of the Central School from which room two other cases developed the same day, it was believed that the three cases were from personal contact with a mild case in a child who was in attendance in the same room up to March 1. This book was given a clean bill of health. Eight other books of this class were traced.

Another suspected book was taken from the library by Marvin B., November 9, and was returned November 14. He developed a condition which was diagnosed as a tonsillitis, about November 7, but which proved to be a mild scarlet fever. Quarantine was established November 20, 1910. This book was being read by B. during the early part of his sickness, and was returned by him to the library before he was quarantined. The book was next taken home by Warren D. where there are four children in the family who never had the disease, without carrying the infection.

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It was then returned to the library where it remained from Dec. 7, 1910, until Feb. 2, 1911, when it was taken out by Ruth M. who had had the disease ten years previously. February 23 it went into the C. home where there were seven children, and from there to the Floyd B. home with four children; neither the C. nor the B. children had previously had the disease nor did they develop it from this book.

In none of the recent or present cases were the library books held responsible for the spread of the disease.

4. Unfumigated Books.—When it was attempted to ascertain if books which had been in homes during or immediately following scarlet fever, when neither houses nor books had been fumigated, had acted as carriers of the disease, the evidence pointed conclusively to the books being at least not important factors in the spread of the disease. About forty books were carefully traced and records studied with no specific evidence against them. These books have been freely used during the past year and have produced no cases. Scarlet fever developed this spring, the exact source being unknown; but it is believed to have come from outside the city, and the isolation of the cases has put the disease in check with only three reported cases and possibly another case, which was not reported, but which was the probable source of the contagion in the city. The books were held blameless.

5. Burned Books.—Books that had been burned while they were in homes where scarlet fever developed were proved to be probably as innocent of acting as carriers, as either of the other classes. One book belonging to this class was taken out of the library by David L. November 1. His brother developed the disease Nov. 3, 1910, not having read the book. This book is not a very popular one, had few borrowers with no history of having been exposed to the disease, and therefore could not be charged with producing the disease.

At the beginning of this investigation of the public library, as fast as any suspicious book was discovered it

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was taken from the shelves and put in the store-room and kept there until the study had been completed. The weight of evidence indicated clearly that the books were not an important factor in the spread of the disease, and they were placed back on the shelves without being fumigated and again put in circulation, without producing the disease and no scarlet fever developed in the city proper between July, 1910, and April, 1911. The last case among the university students occurred March 16, 1911, and during this interval from March, 1911, to May 25, 1912, the students have been using the university library and also using rented books from the university bookstores, showing that these books cannot be regarded as carriers of the disease. This to my mind warrants the following conclusions:

CONCLUSIONS

1. If books act as carriers, it is only immediately after being contaminated with the discharges of the patient; yet this investigation has failed to reveal a single instance of this kind.

2. Books that have been used by scarlet fever patients do not long contain the infection in such a way as to transmit the disease to man.

3. Any book which has been handled by a scarlet fever patient should be burned or fumigated. The most practical method for general book disinfection at this time is the Beebee carbogasoline method. This consists in using gas-machine gasoline and 2 per cent. phenol crystals; the books are immersed in this mixture for twenty minutes, removed and placed before an electric fan for two minutes, and then set on end for from twenty-four to forty-eight hours.

The supplemental study books used in the Valparaiso public schools were all disinfected by this method last September. Prof. A. A. Hughart and I devised an apparatus for this consisting of a zinc tank 21 inches long, 15 inches deep and 8 inches wide, with a tight-

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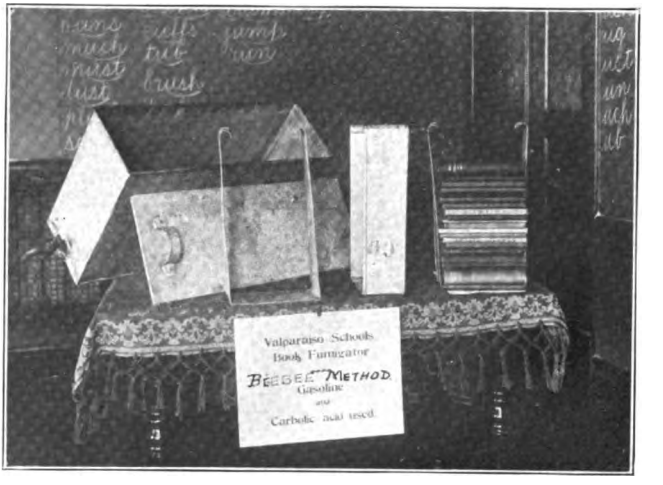

Apparatus for disinfecting books.

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fitting cover. A faucet in one end near the bottom drains off the gasoline. Zinc strips bent in suitable form to serve as racks facilitate the handling of the books.

REPORTS OF TESTS OF GAS-MACHINE GASOLINE AND PHENOL AS A GERMICIDE BY C. H. DE WITT AND H. E. BRIAN

By request of Dr. Nesbit we made these tests to confirm some work done along this line by Beebee. Two series of tests were made, one with the gas-machine gasoline alone, and one with gas-machine gasoline and 2 per cent. of phenol. The thread method of testing was employed and all tests were properly checked by controls in the usual manner. The tests were made with a twenty-minute time-limit by request of Dr. Nesbit, and no tests were made for longer or shorter periods of time.

We tested the following organisms: *Bacillus typhosus, B. diphtheriæ, B. tuberculosis* and a mixed staphylococcus and streptococcus culture from the throat of a suspected diphtheria patient. After seven days no growths have appeared in any of the tubes.

It would seem that both the gasoline and the gasoline and phenol were germicidal under the conditions of the tests. We feel, however, that we want to make more extended tests before making positive statements as to their value.

RECENTLY EXPRESSED VIEWS

Evans,[1] writing about scarlet fever, says:

Dried secretions are not very apt to spread the disease.

In writing of "Control of Contagion," the same author says:

Now we know that we must watch people rather than things, and not all the people at that—merely those who have been in contact with cases of contagion—contact cases and carriers. All effort now is concentrated on these.

Chapin[2] writes:

It now appears that the growth of disease germs outside of the body is not frequent enough to be an important factor in the causation of disease, but their growth in the body

1. Evans, W. A.: How to Keep Well, Chicago Tribune, 1912.
2. Chapin, C. V.: The Sources and Modes of Infection, John Wiley & Sons, 1910.

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without causing sickness, their latency as it were, often for many months, is a factor of very great significance. We know now that direct contact with the sick, or with healthy carriers of disease germs, is an exceedingly frequent mode of transmission, and that infection by means of the air, or from infected articles, is not nearly as common as was formerly believed. . . . The germs of scarlet fever, diphtheria and small-pox are supposed to become attached not only to books, playthings, bedding and furniture, but also to the walls and ceilings. It is true that anything that can be reached by the patient or attendant may possibly receive infection, the chance increasing according to the frequency with which the thing is handled. That parts of the room or its contents not touched by floating particles containing infection is highly improbable.

Doty[3] believes that the careful and systematic examination of school children proves that persons and not things transmit disease. It is his opinion that books can be disinfected only by steam. If there is a specific or even reasonable evidence that certain books are contaminated by infected discharges, they should be burned if they cannot be treated with steam; but this treatment need not be extended to other books in the same school or apartment. Although books in some rare instances may possibly transmit disease, there is no reason to believe that in a general way they constitute a medium of infection, and there is no necessity or justification for the attempts which are sometimes made to disinfect them periodically under these conditions, first, because it is unnecessary, and second because it would be practically impossible to carry out this treatment. Therefore the disinfection of books should be restricted to specific instances in which there may be sufficient evidence to justify this procedure.

The belief has long existed that infectious diseases are transmitted not only from one person to another, but commonly through the medium of articles or materials known as "fomites," which are believed to be capable

3. Doty, A. H.: Prevention of Infectious Diseases, D. Appleton & Co., 1911.

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of retaining infectious germs in the active state. These include clothing, bedding, baggage, cargoes of vessels, money, rags, etc. This belief is very old and has dominated all health regulations designed to guard against outbreaks of infectious disease. Curiously enough, there has been but little evidence presented to uphold the fomites theory, and its chief support lies in the fact that it offers a plausible explanation for the occurrence of outbreaks of infectious disease the origin of which is unknown.

Practical sanitarians who have given the matter careful study are slowly but surely accumulating conclusive proof that most infectious diseases are only in very rare instances transmitted by clothing or other textile fabrics.

Doty's investigation of rags as carriers in 1897 and his study of money as a carrier showed these mediums to be not a frequent cause of disease.

Hilditch[4] writes:

I do not say it is impossible for money to act as a medium of infection, but if it does occur, it is only in rare instances and this question must be settled principally by practical experience.

Hedges' conclusions[5] are as follows:

1. The theory of infection by fomites has been accepted from time immemorial not from scientific, but from *a priori* grounds. 2. While the possibility of infection from these sources in certain isolated cases may be admitted, the danger is far less than commonly supposed. 3. Contact infection and the dangers to the community from "missed" and "carrier" cases are the most potent factors in the spread of these diseases. 4. By observing the simple laws of personal cleanliness, by scrupulously cleansing the hands and nails after contact with these patients, the danger incurred by the physician or attendant in transferring the disease to others is reduced to a minimum.

4. Hilditch, W. W.: A Bacteriologic Study of Soiled Paper Money, Pop. Sc. Monthly, lxxiii, 157.

5. Hedges: Contact Infection in Contagious Diseases, Arch. Pediat., April, 1912.

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Haynes[6] takes the stand that scarlet fever and diphtheria may be transmitted, if the contamination be recent, by means of infected utensils, toys, clothing, books or other things, and relates the story of a New York family in which one of the children had diphtheria, the other children being sent south. Some time afterward, when the sick child had recovered, the children in the South took the disease. The medium of transmission was found to be a woolly dog played with by the child in New York and sent south to the other children.

The reports of the Michigan State Board of Health (1906, p. 134, and 1907, p. 133) give instances of the persistence of the scarlet fever virus for years in houses, letters, books, etc.

The Detroit Board of Health report (June 30, 1903, p. 11) cites two cases of scarlet fever from books which had been used by a patient some months before.

DETAILS OF TESTS

In the copy of the records following the names of the borrowers are given under the name of the book, with the date the book is to be returned (unless date taken out is indicated). To determine the date taken out subtract fourteen, the number of days allowed a borrower, from the return date. The last column contains the dates of scarlet fever in the family of the borrower.

The following books were suspected; some were in homes which had been fumigated before the books were returned, and others in families at the time or just before scarlet fever developed:

MIDSHIPMAN PAULDING

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Gerland P.	12/19/10	+	3/10/09
Fredric A.	1/29/11	—	
David L.	2/18/11	+	11/3/10
Mark G.	2/27/11	—	
Lain H.	2/1/11	+	4/23/11

6. Haynes: Prevention of Contagious Diseases, Arch. Pediat. April, 1912.

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TWO LITTLE SAVAGES

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Wesley H.	6/ 1 /10	—	
Harriet G.	6/12/10	+	6/18/11
Malcolm J.	8/23/10	—	
Rose W.	10/26/10	—	
Jesse P.	2/16/11	+	11/../08
R. F.	3/21/11	—	

DOROTHY DAINTY

W.	6/ 3/10	—	
Fred C.	6/17/10	+	6/15/09
Mrs. M.			
H.			
S.			
S.			
Pearl C.			
D. E. K.			
Eva B. ....Taken	9/10/10		
Returned	9/21/10	+	9/29/10
B.		+	9/../08
G.	10/30/10	+	6/18/10

LITTLE COLONEL STORIES

Margaret B.	3/ 3/10	+	11/../09
Pearl O.	6/14/10		
Ella G.	7/31/10	+	5/../10
William H.	8/14/10		
Helen H.	9/20/10		
Ivan C.	10/17/10	+	6/15/09
Martha B.	11/ 1/10		
Gladys V.	11/ 5/10		
Margaret D.	11/17/10		
Geneva H.	11/18/10	+	7/25/10
Helen H.	11/25/10	+	1898
Martin A.	12/ 6/10	+	4/../09
Richard M.	12/26/10		
Bruce B.	1/17/11		
Harry G.	1/26/11	+	6/ 8/10
Eda L.	2/18/11	+	10/../09
Jeanette F.	3/ 9/11	+	3/ 4/11

STORIES MOTHER NATURE TOLD TO HER CHILDREN

Louise D.	10/ 6/10	+	7/30/10
John H.	10/25/10	+	12/27/11
Martin E.	11/14/10		
Frank P.	11/25/10		
Emma B.	12/13/10		
Charles C.	12/19/10		
Lillian D.	1/20/11		
Lester A.	3/ 1/11		
Minor	11/12/10		
Gretchen S.	11/27/10		

Destroyed Dec. 1, 1910, so badly worn.

OLD-FASHIONED GIRL

Pearl L.	6/ 8/10		
Mrs. S.	6/28/10		
Helen B.	7/15/10		
Katie L.	9/ 5/10		
Lillian N.	9/30/10		
Harrison S.	11/11/10		
Grace H.	11/23/10	+	1904
Edna M.	12/ 7/10		
Lillian C.	12/20/10	+	1900
Lillian T.	1/ 6/11	+	3/23/11
Pearl M.	1/21/11		
Gertrude H.	1/30/11	+	1901
Lauretta H.	2/ 5/11		
Marion D.	3/ 2/11		
G. M.	3/15/11		

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THE FIVE LITTLE PEPPERS AND HOW THEY GREW

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Kathleen D.	6/ 4/11	+	1910
Irene T.	7/23/10	+	1905
Vera C.	8/28/10	+	6/15/09
Gertrude M.	9/ 9/10		
Amelia S.	10/ 2/10		
James N.	10/22/10		
Walter S.	10/28/10	+	10/16 to 11/14/10
Laura J.	11/29/10		
Selma C.	12/ 9/10		
Eva K.	12/30/10		
Vera J.	1/ 1/11	+	7/../10
Theresa M.	2/11/11		
Margaret Y.	2/23/11		
Harriet G.	3/ 6/11	+	6/18/10

BOYS OF BOB HILL

Rosemary L.	6/ 6/10	+	10/../11
Howard L.	6/10/10		
Frances G.	9/26/10		
Harry M.	10/11/10		
Walter S.	10/20/10	+	10/16 to 11/14/10
Harry W.	11/ 2/10	+	1910
Frank W.	11/ 6/10	+	6/../10
Walter E.	11/ 9/11	+	
John E.	11/18/10		
Ed. S.	11/28/10		
Book rebound.			
Roy P.	2/ 6/10		
Walter C.	2/ 3/10	+	3/10/09
David L.	2/21/10	+	11/../10 brother had scarlet fever.
Grace W.	2/27/10		
Evylan D.			1900

The following books have been in some homes that have had scarlet fever with no fumigation of houses or books:

THE SNOW MAN

Katherine E.	7/25/10	+	3/../09
Joseph S.	8/29/10		
Lester A.	9/20/10		
Louise D.	9/29/10	+	7/30/10
Blanche O.	10/ 7/10		
Warren D.	10/23/10		
Velmer M.	10/11/10	+	3/13/09
Emma M.	11/ 7/10		
Rachael McG.	11/ 9/10	+	6/15/10
Rachael C.	11/10/10	+	11/../09
Charles F.	11/13/10	+	11/../08
Elmer S.	11/20/10		
	12/ 4/10		
Nina P.	12/12/10		
Della S.	12/14/10		
Abbie W.	12/16/10		
Harold S.	12/20/10	+	08
Everett P.	1/17/11		
George J.	1/18/11		
Milford M.	1/19/11		
Frank P.	1/19/11		
G.	1/20/11		
Gordie H.	1/28/11	+	09
Mulluis McG.	1/29/11		
Ernest L.	2/ 2/11		
Leyle K.	2/23/11		
Dorothy M.	3/ 1/11	+	8/../09
Raymond G.	3/ 3/11		
Gordie K.	3/ 9/11	+	09
Anna C.	3/17/11	+	09

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OUR LITTLE INDIAN COUSIN

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Ruth M.	8/12/10	+	8/../10
Florence H.	11/../10		
Ivan C.	11/ 4/10	+	6/15/09
Richard L.	11/14/10		
Cartha C.	11/22/10	+	12/21/10
Marvin B.	12/19/10	+	10
Everett P.	1/19/11		
Harry J.	2/15/11		
Dwand W.	3/ 1/11		

DAVY AND THE GOBLIN

Pearl C.	7/20/10		
Fern B.	9/12/10	+	9/../08
Cecil D.	11/30/10	+	00
Dorland B.	10/ 9/10		
Gordie H.	10/20/10	+	09
George H.	11/ 8/10	+	1/ 3/11
Florence G.	11/23/10		
Charles F.	12/ 9/10	+	11/16/08
Herbert K.	12/12/10		
Frank P.	1/ 6/11		
Hubert M.	1/18/11	+	12/../09
Rachael McG.	1/18/11	+	7/15/00
Ethel K.	9/28/11	+	08
Katherine F.	2/ 3/11	+	12/12/10
Hazel B.	2/ 3/11		
Warren D.	2/27/11		
Carrie S.	.....	+	09

TALES OF OLD ENGLAND

Blanche O.	9/26/10		
Walter S.	9/27/10		
Margaret B.	10/17/10	+	4/../09
Lucile B.	10/17/10		
Mary W.	11/ 4/10		
Gordie H.	11/10/10	+	09
Hazel B.	11/10/10		
Ella F.	11/17/10		
John H.	11/22/10	+	1/31/11
James S.	12/ 7/10		
Ruby B.	12/13/10	+	08
Laretta H.	12/27/10		
Russell P.	1/ 6/11		
Lucile B.	1/28/11		
Ray C.	1/30/11		
Hattie L.	2/15/11		
Bruce B.	2/19/11		

OUR LITTLE JAPANESE COUSIN

Fern B.	9/22/10	+	9/../08
Lillian D.	9/ 7/10	—	
Marvin B.	11/23/10	+	11/20/10
Warren D.	12/ 7/10	—	
Ruth M.	2/16/11	+	00
Lucile C.	3/ 9/11	—	
Floyd B.	.....		

BOOK OF NATURE

Herbert M.	5/31/10
Blanche O.	6/ 6/10
Warren D.	6/18/10
Lester A.	9/24/10
Frank P.	10/ 7/10

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BOOK OF NATURE.—Continued

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Fred B.	11/ 2/10	+	1/../11
			7/../09
Louise S.	11/14/10		
Hazel McC.	11/29/10	+	01
Lottie C.	12/26/10		
Otto O.	12/26/10		
Russell P.	1/20/11		
Charles F.	1/30/11	+	11/../08
Sarah W.	2/ 1/11		
Theo. L.	2/19/11	+	11/ 3/09

GAMES BOOK FOR BOYS AND GIRLS

Gladys D.	7/21/10	—	
Nina P.	7/24/10	—	
Helen McD.	7/ 8/10	—	
Dorland B.	9/ 9/10	—	
Bernard S.	9/29/10	—	
Roy L.	10/12/10	—	
Myrtle J.	11/ 9/10	—	
Lauren M.	11/22/10	+	8/../09
Agnes W.	12/23/11	—	
Grace B.	12/23/10	+	2/17/09
Edwin S.	1/12/11	+	1/29/11
Frederick A.	1/20/11	+	09
David L.	3/12/11	+	11/ 3/10
Wesley H.	3/25/11		

TAYLOR OF GLOUCESTER

(Out of circulation from May to September)

Louise M.	9/22/10	—	
Viola L.	11/ 3/10	+	09
Clifford G.	11/11/10	—	
C.	11/29/10	—	
Montgomery	12/ 1/10	—	
Mamie E.	12/13/10	+	08
Pearl McM.	1/ 2/11	—	
Herber K.	1/ 9/11	—	
Professor C.	1/22/11	—	
Hazel B.	2/ 2/11	—	
Alma S.	2/ 9/11	—	
William McG.	2/13/11	—	
Glendon S.	3/ 6/11	+	08

TALE OF MR. JEREMY FISHER

Theo L.	5/27/10	+	11/ 3/10
Louise M.	7/ 2/10	—	
Mrs. B.	6/17/10		
Returned by	6/ 7/10		6/24/10
Gladys T.	6/21/10	+	4/23/11
Marjorie C.	7/10/10	+	6/../09
Robert L.	11/ 2/10	—	
Lenora B.	11/12/10	—	
Jeanette B.	11/25/10	—	
Harold H.	12/ 2/10	+	7/25/10
Russell B.	12/13/10	+	09
Guy B.	12/17/10	+	3/20/09
Herber K.	1/11/11	—	
L. L.	1/24/11	+	11/../09
Annett K.	2/13/11	—	
Glenden S.	2/13/11	+	08
Lillian D.	2/14/11	—	
Marrion C.	2/20/11	—	
Roger W.	3/ 2/11	+	5/19/10

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PALMER COX BROWNIE PRIMER

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Mrs. M. P.	6/22/10	—	
Inezetta B.	11/ 4/10	—	
Arthur M.	11/10/10	+	09
Norman H.	11/20/10	—	
Anna C.	12/ 6/10	+	09
Edna P.	12/10/10	—	
Sylvia C.	1/ 1/11	+	7/ 4/10
Gordie K.	1/24/11	+	4/23/10
Mamie C.	3/13/11	—	

ROAD TO OZ

Luise B.	6/ 6/10	4 wks.	
Herbert M.	6/16/10		
Irene T.	7/ 2/10	+	05
Katherine D.	7/15/10	—	
Bennie McG.	7/28/10	+	04
Louise M.	9/ 8/10	—	
Mary L. J.	9/26/10	—	
Richard M.	10/18/10	—	
William F.	11/ 3/10	+	12/10/10
Anna C.	11/11/10	+	09
Ellen A.	11/18/10	+	09
Dorothy M.	11/30/10	4 wks.	8/../09
G.	12/ 7/10	+	12/../09
Hubert M.	12/16/10	—	
Warren D.	1/ 2/11	—	
Harry G.	1/21/11	+	6/18/10
O.	1/26/11		
G.	1/30/11	+	6/18/10
Louise M.	2/14/11		
Floyd B.	2/28/11		

LITTLE INDIAN FOLKS

O.	5/21/10	—	
H. S.	6/ 7/10	+	08
B.	6/ 9/10	+	4/ 6/09
Martin A.	6/12/10	+	4/../09
Arthur C.	7/13/10	—	
Anna C.	7/30/10	+	11/../09
Warren D.	9/ 1/10		
Gladys J.	9/29/10		
Dorothy M.	10/19/10	+	8/../09
Mr. B.	10/25/10		
Louise W.	11/ 9/10	+	07
Lucile W.	11/16/10		
Dr. E.	11/22/10		
C.	11/18/10		
Ivan C.	11/25/10	+	09
Hubert M.	11/28/10	+	12/../09
Roger W.	12/ 3/10	+	9/13/09
D.	12/10/10	+	5/../09
B.	12/29/10	+	08
K.	1/18/11		
K.	2/14/11	+	09
L.	2/17/11	+	09
May C.	3/10/11	+	09

TREES THAT EVERY CHILD SHOULD KNOW

S.	8/16/10	+	08
B.	11/11/10	+	1/ 3/11 7/../09
D.	11/18/10		

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TRUE BEAR STORIES

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Howard L.	6/ 5/10		
Leslie C.	6/10/10		
Gracia G.	9/25/10		
Ray M.	10/10/10	+	8/../09
Ruth M.	10/30/10		
William B.	11/ 7/10	+	08
Maurice E.	11/11/10		
Virgil T.	11/28/10		
Irene T.	12/12/10	+	05
Marie R.	12/26/10		
Cecil D.	1/27/10	+	00
Zerah B.	3/ 6/11	+	6/12/09
Earl E.	8/14/11		

BROWNIES ABROAD

Gordie H.	6/ 1/10	+	09
Robert C.	6/14/10	+	09
Book rebound.			
Martin P.	11/ 2/10	+	09
Warren D.	11/ 9/10		
Harry B.	11/23/10		
Louise W.	11/27/10	+	2/../07
Inezetta B.	11/30/10		
Arthur M.	12/ 3/10		
Robert C.	12/ 6/10	+	11/../09
Ivan C.	1/24/10	+	6/15/09
Oral B.	2/ 1/11		

BROWNIES AROUND THE WORLD

Gordie H.	7/29/10	+	09
Leslie C.	8/31/10		
Ernest L.	9/16/10		
Earle P.	10/12/10		
Ruth D.	11/ 8/10		
Bruce B.	11/10/10		
Leslie Van D.	11/21/10	+	3/ 2/11
Carrie McC.	12/ 4/10	+	3/11/11
Della S.	12/19/10		
Roger W.	12/27/10	+	9/../09
Floyd B.	1/18/11		
Raymond G.	1/26/11		
Bertha B.	2/ 6/11		
Louise D.	2/18/11	+	7/30/10

FIRST BOOK OF AMERICAN HISTORY

Harrington S.	7/21/10		
Dorland B.	10/27/10		
Carrie S.	11/11/10	+	11/../09
Robert B.	11/30/10		
Charles McG.	11/30/10	+	7/15/10
Wesley H.	2/22/11		
Earl P.	3/ 9/11		

LITTLE LAME PRINCE

Lucila C.	10/25/10		
Nina P.	11/ 2/10		
Violet C.	11/ 4/10		
Edna L.	11/ 8/10		
Helen M.	11/25/10	+	09
Book rebound.			
Gordie H.	2/ 8/11	+	09
Ivan C.	2/19/11	+	6/../09
Hazel L.	3/ 3/10	+	10

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BOOK OF NATURE MYTHS

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Hubert M.	5/31/10		
Blanche O.	6/ 6/10		
Warren D.	6/18/10		
Lester A.	9/24/10		
Frank P.	10/ 7/10		
Fred B.	11/ 2/10	+	09
Basil McC.	11/29/10		
Jesse W.	12/ 1/10		
Otto O.	12/26/10		
Russell P.	1/20/11		
Charles F.	1/31/11	+	11/../08
Sarah W.	2/ 1/11		
Theodore L.	3/ 5/11	+	11/../10

TALE OF TOM KITTEN

Robert W.	6/14/10		
Gladys T.	7/ 5/10	+	4/23/11
Dwand W.	10/18/10		
Phyliss S.	3/ 3/10		
Milton L.	11/14/10	+	2/ 1/11
Murrel D.	11/22/10	+	5/../09
Katherine D.	12/ 5/10		
Russell B.	12/23/10		
Viola L.	1/ 2/11	+	09
Anna C.	1/19/11	+	09
Sylva C.	1/29/11		
Mrs. A. D. B.	2/10/11		
Ruth M.	2/16/11		

ON GENERAL THOMAS' STAFF, COPY 1

Harry B.	6/ 3/10		
Andrew D.	6/20/10	+	09
Wesley H.	6/30/10		
	7/14/10		
Kate L.	7/30/10		
Fraviola J.	8/ 6/11		
Walter E.	8/19/10		
Milo B.	8/27/10	+	09
Archie H.	9/ 5/10		
Charles R.	10/17/10		
Carl B.	11/ 1/10		
Harriet G.	11/22/10	+	6/18/10
Howard L.	11/ 7/10		
Edward S.	11/16/10		
Ralph McG.	11/19/10		
Ray M.	11/25/10	+	8/../09
Floyd B.	12/16/10		
Walter E.	1/ 2/11	+	3/ 1/11
Deforest M.	1/15/11	+	05
Walter E.	1/20/11		
Victor K.	1/26/11		
Harry E.	1/31/11	+	3/ 1/11
Floyd C.	2/15/11	+	12/../01
Merritt C.	3/ 1/11		
Eva B.	3/ 9/11	+	10/../09
Bruce L.	3/17/11		

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RAIDING WITH MORGAN, COPY 1

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Ralph O.	6/ 9/10	+	06
Albert C.	6/26/10		
Frederick A.	7/ 6/10	+	09
Clayton M.	7/15/10	+	04
Allen D.	8/19/10	+	09
Walter C.	8/25/10	+	8/10/09
Walter E.	8/31/10		
Archie H.	9/10/10		
Aubrey D.	9/18/10	+	09
Milo B.	9/23/10	+	09
Charles R.	10/ 7/10		
Ray M.	10/21/10	+	8/../09
Donald C.	11/ 3/10		
Ralph McG.	11/14/10		
Ralph O.	11/20/10		
Forrest P.	12/ 3/10		
Walter E.	12/19/10		
Earl T.	12/24/10		
Edwin S.	1/ 3/11	+	1/27/11
Herman M.	1/ 4/11		
DeForest M.	2/ 3/11	+	05
Frank W.	2/26/11	+	5/19/10
David L.	3/ 9/11	+	11/../10
Mrs. L. A. B.	3/11/11		
H. H. L.			

FISHING AND HUNTING

Charlotte J.	5/29/10		
Richard L.	6/24/10	+	2/ 1/11
Fred B.	11/ 4/10	+	09
Milford M.	11/15/10		
Marjorie C.	11/20/10	+	6/15/09
Oliver S.	11/22/10		
Hazel B.	12/ 3/10		
Theo. L.	12/11/10	+	11/ 3/10
Emily D.	12/19/10		
Bryan L.	12/21/10	+	09
Milford M.	1/17/11		
Fred B.	1/18/11	+	1/ 3/11
Earl P.	1/18/11		
Oliver S.	1/19/11		
Frank P.	1/24/11		
Claude B.	2/11/11		
Kenneth P.	2/22/11		
Lester A.	3/ 6/11		
Lyal K.			

GENERAL NELSON, SCOUT, COPY 1

Andrew D.	8/../10	+	09
Milo B.	8/23/10	+	09
Mary P.	9/ 8/10	+	10/../09
Paul D.	10/12/10		
Barbara W.	10/27/10		
Ray M.	11/ 2/10	+	8/../09
Eugene B.	11/ 9/10		
Herman M.	11/23/10		
Harry B.	12/ 5/10		
Roy L. P.	12/ 9/10		
William F.	12/15/10		
DeForest M.	1/ 2/11	+	05
Ernest E.	1/12/11	+	3/ 1/11
Ralph O.	1/27/11		
David L.	2/10/11	+	11/../10
Claudie G.	2/18/11	+	6/18/10
Harry B.	2/23/11		
Willie B.	3/ 2/11		
Wayne C.	3/ 7/11		
Bruce L.	3/16/11		

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BALDWIN'S ROBINSON CRUSOE

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Blanche O.	6/ 3/10		
Oliver S.	6/ 8/10		
Marguerite B.	6/20/11	+	09
Mrs. W. P.	8/ 3/10	+	3/ 8/09
Thomas M.	10/ 6/10		
Russell P.	10/28/10		
Lester A.	11/ 6/10		
Milford M.	11/20/10		
Willie B.	12/ 5/10		
Helen H.	12/12/10		
Louise D.	12/26/10	+	7/30/10
Gladys R.	1/ 4/11	+	1/27/09
Fred B.	1/18/11	+	1/ 3/11
			7/../09
Chester S.	1/21/11		
Russell B.	1/24/11		
J. R. H.	2/ 9/11		

BROWNIES THROUGH THE UNION

Mrs. O. A. D.	6/ 4/10		
Martin A.	6/25/10	+	4/../09
Thomas M.	10/20/10		
Bonnie R. P.	11/ 4/10		
Book rebound.			
Mrs. N. P.	2/ 6/11	+	12/../08
Dorothy D.	2/12/11		
Burdette D.	3/12/11		
Gordie H.	3/17/11	+	09

CHILDREN'S BOOK

Ellen A.	7/ 3/10	+	09
Martha W.	8/12/10		
John C. H.	9/ 1/10	+	1/31/11
Harriet G.	9/18/10	+	6/18/10
Selma C.	11/ 4/10		
Catherine F.	11/17/10	+	10
Rachel McG.	11/28/10	+	7/../10
Nora Z.	12/ 9/10		
Vera J.	12/26/10	+	7/../10
Ivan C.	2/ 7/11	+	09
June W.	2/12/11		
Blanche O.	2/23/11		
Harry B.	3/ 6/11		
Abbie W.	3/18/11		

CHILD'S GARDEN OF VERSES

Lucile B.	6/ 7/10		
Mildred P.	6/ 9/10		
Bertha Z.	6/16/10		
Earl S.	9/27/10	+	10
Anna M.	11/ 3/10		
Ruth M.	11/10/10	+	10
Louise W.	11/14/10	+	07
Jeanette B.	12/ 2/10		
Bulah K.	12/19/10		
Marjorie C.	1/17/11	+	6/15/11
Lyal K.	1/23/11		
Mamie C.	1/27/11		
Dorothy M.	2/ 1/11	+	8/../09
Inezetta B.	2/14/11		
Lucy R.	3/ 5/11		

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OUR LITTLE SWISS COUSINS

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Ruth M.	7/28/10	+	10
Marvin B.	11/ 9/10	+	11/20/10
Ira J.	12/14/10		
Bulah K.	1/21/11		
Mira B.	2/18/10		

DOROTHY AND THE WIZARD OF OZ

Bertha H.	7/23/10		
Cecelia K.	9/ 7/10		
Sarah W.	9/30/10		
Richard M.	10/ 4/10		
Blanche K.	10/20/10	+	09
Marjorie C.	10/26/10		
Ruth M.	11/ 2/10		
Florence G.	11/10/10		
Abbie B.	11/15/10		
Gordie H.	11/30/10		
Frank P.	12/ 9/10		
Blanche O.	12/30/10		
Charles F.	1/ 2/11	+	11/../08
Harriet G.	1/17/11	+	6/18/10
Newman J.	1/24/11	+	6/../10
Marjorie C.	2/10/11	+	6/15/09
Annette K.	2/17/11		
Alberta M.	3/ 3/11		
Edwin S.	3/20/11	+	1/27/11

PETER AND ELLEN

Carrie S.	6/14/10	+	09
Louise B.	6/20/10		
Frank B.	7/ 9/10		
Katilen D.	8/ 4/10		
Amelia S.	8/26/10		
Genevieve H.	9/ 3/10		
Mary E. J.	9/11/11		
Ruth F.	9/27/10		
Blanche O.	10/12/10		
Gretchen S.	10/16/10		
Vera J.	11/13/10	+	7/../10
Emma B.	11/15/10		
Claude G.	11/20/10		
Mary K.	11/27/10		
Book rebound.			
Irene B.	2/ 1/11	+	08
Louise M.	2/10/11		
Dorothy M.	2/14/11	+	8/../09
Claude B.	2/22/11		
Sarah W.	3/ 3/11		
Katherine E.	3/ 6/11		
	3/20/11	+	3/../09

STORIES OF FAMOUS PICTURES

Dorothy D.	9/28/10		
Gordie H.	10/19/10	+	09
Carrie S.	10/25/10	+	09
Marjorie C.	10/30/10	+	6/../09
Vera J.	11/ 6/10	+	7/../10
Hattie L.	11/ 7/10		
Ruth F.	11/20/10		
Anna C.	11/27/10	+	09
Mildred J.	11/28/10	+	11/../08
Mary K.	12/15/10		
Ellen A.	12/31/10	+	09
Katherine D.	1/17/11		
Harry J.	2/ 1/11		
George J.	2/15/11		
Inezetta B.	3/2-9/11		
Lyal K.	3/20/11		

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FOLKS-LORE READER

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Vernita B.	6/ 6/10	+	6/../09
Theo. L.	9/ 6/10	+	11/ 3/10
Ruth D.	11/ 3/10		
Vera J.	11/10/10	+	7/../10
Sylva C.	11/13/10		
Gladys B.	11/16/10	+	1/27/09
Jeanette B.	11/18/10	+	04
Fannie S.	11/29/10		
Basil McC.	12/ 4/10		
Martin P.	12/ 7/10	+	08
Theo. L.	12/18/10	+	11/../10
Anna C.	12/23/10	+	09
Roger W.	12/27/10	+	9/../09
Marvin B.	1/ 2/11	+	11/20/10
Hubert M.	1/ 5/11	+	12/../09
Dorothy M.	1/18/11	+	8/../09
Ellemina F.	1/23/11		
Gordie K.	1/30/11	+	4/23/10
Lyal K.	2/10/11		
Mammie C.	3/ 2/11		
Emer G.	3/ 7/11		
Katherine D.	3/18/11		

GRADED LITERATURE READER

Bruce S.	5/23/10	+	11/ 6/10
Leo L.	6/14/10		
Harrington S.	7/17/10		
Dorothy M.	10/20/10	+	8/../09
Kenneth P.	11/ 3/10		
Anna C.	11/14/10	+	09
Marjorie C.	11/20/10	+	6/../09
Dwane W.	11/16/10		
Blanche O.	11/22/10		
Amanda G.	11/23/10		
Fannie S.	12/10/10		
Ruby B.	12/21/10	+	08
Inzetta B.	1/21/11		
Mannie C.	1/31/11		
Ellemina F.	2/13/11		
Ferrol J.	2/17/11	+	10
Ruth M.	2/27/11		
Gordie K.	3/16/11	+	4/../10

LITTLE RED RIDING HOOD

Fred B.	6/ 6/10	+	09
Harrington S.	6/19/10		
S.	7/17/10		
Richard M.	8/ 5/10		
Mark L.	10/14/10		
Myrtle A.	11/ 2/10		
Dwane W.	11/ 6/10		
Mrs. S.	11/11/10		
Guy B.	11/22/10		
August W.	12/ 3/10		
Zelda F.	12/16/10		
Anna C.	12/19/10		11/../09
Ruth M.	12/27/10		
Gladys R.	1/10/11	+	09
Russell P.	1/23/11		
Orvil B.	1/26/11		
	2/ 8/11	+	8/16/09
Bennie B.	3/ 6/11	+	1/ 3/11
			7/../09

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JACK THE GIANT KILLER

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Ruth J.	10/11/10		
William F.	10/18/10	+	12/10/10
Ruth B.	11/ 2/10		
Josephine W.	11/ 9/10		
Martin E.	11/23/10		
Bulah K.	12/ 1/10		
Christine L.	12/14/10	+	09
Delta S.	12/14/10		
Oral B.	12/18/10		
Sylvia C.	1/18/10		
Raymond G.	1/30/11		
Nina P.	2/ 6/11		
Dorothy M.	2/10/11	+	8/../09
Leslie P.	2/24/11		
Ernest L.	2/11/11		
Glendon S.	3/21/11	+	08
Mrs. M.	3/23/11		
Everett P.	3/28/11		

STORIES OF BRAVE DOGS

Harriet G.	10/26/10	+	6/ 8/10
Marion A.	11/ 1/10		
	11/13/10	+	12/../09
Lauren M.	11/28/10	+	8/../09
Book rebound.			
Charlotte J.	2/ 2/10	+	11/../08
Marguerite B.	2/13/10	+	09
Helen M.	2/20/10	+	08
Birdelle D.	3/ 3/10		
Ivan C.	3/13/10	+	6/15/09
Eva B.	3/15/10		10/../09

Every borrower had previously had scarlet fever before and after Birdelle D.

The following books were in the home of the last-named borrower when scarlet fever developed, and were burned.

A LETTER FROM A CAT

Emma M.	11/ 3/10		
Vera J.	11/ 7/10	+	7/../10
Elizabeth O'C.	11/ 7/10	+	7/15/10
Beulah K.	11/21/10		
Gladys V.	11/25/10		
Anna C.	11/28/10	+	11/../09
Sherwood. Taken 11/17.	12/ 1/10	+	11/../10
Book burned.			

IN THE LINE

Aubrey D.	6/30/10	+	00
Edwin S.	7/ 6/10	+	1/27/11
Carl B.	11/16/10		
Carl S. Taken 11/6.	11/20/10	+	11/19/10
Book burned.			

AROUND THE WORLD

Joseph S.	10/ 2/10		
Marvin B. Taken 11/14.		+	11/ 7/10

Book reported burned Dec. 5, 1910, as case was quarantined Nov. 28, 1910.

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STORIES OF THE RED CHILDREN

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Terry M.	7/14/10		
Blanch O.	7/17/10		
Phyllis S.	7/27/10		
William B.	10/ 2/10	+	4/../09
Dwane W.	10/20/10		
Theo. L. Taken 10/17. Book burned.		+	11/ 3/10

OVERALL BOYS

Catherine F.	7/ 9/10	+	12/14/10
Louise M.	7/28/10		
Charles F.	7/24/10	+	11/../08
Leslie C.	8/ 9/10		
Joseph S.	8/19/10		
Louise M.	9/11/10		
Vera J.	10/12/10		
Marjorie C.	10/27/10	+	6/15/09
Raymond G.	11/../10		
Richard L.	11/ 3/10	+	09
Anna C.	11/15/10	+	09
Lucile E.	11/16/10		
Wallace S. Taken 11/11.	11/25/10	+	11/19/10

OUTDOOR HANDY BOOK

Fravola G.	1/18/10		
Frank B.	8/19/10	+	7/../09
Mark L.	10/ 9/10		1/ 1/11
James N.	10/13/10	+	6/../10
David L. Taken 11/1.		+	11/ 3/10

TRUE STORY OF BENJAMIN FRANKLIN

George B. Taken 11/1. The first time the book has been out since May, 1910.		+	6/24/10

STORY OF EDISON

Ruth. B. Taken 6/11. First time out since May, 1910.		+	6/24/10

The following books were the ones in the homes just previous to the developing of scarlet fever in the recent cases, April and May, 1912.

STORIES OF PIONEER LIFE

Arthur H.	12/21/10		
Harry McC.	1/ 3/10		
Hattie L.	1/23/10		
Oliver S.	1/30/10		
August W.	2/11/11		
Carleton H.	2/26/11		
Harry M.	3/ 6/11		
Alva H.	3/17/11	+	4/../09
Frank P.	3/31/11		
Leonard M.	4/24/11	+	7/../10
William McG.	5/10/11		
Byron L.	6/28/11	+	09
Lloyd G.	9/25/11		
Vera W.	11/ 9/11		
Ransom O.	12/ 8/11		
Vernitta B.	2/19/12	+	6/../09
Lee S.	2/21/12	+	4/../11
Milford M.	3/ 5/12		
Everett P.	3/10/12		
Dwane W.	3/15/12		
Lucile W.	4/ 8/12	+	5/28/09
Phyllis S. Taken 4/18. Not out since.	5/ 2/12		

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DOROTHY DAINTY AT THE MOUNTAINS

Borrower.	Book Due.	Had Scarlet Fever.	Date.
Genevieve C.	10/20/11		
Myron C.	10/27/11		
Ethel K.	10/30/11	+	08
Carrie S.	11/ 5/11		
Martha D.	11/ 8/11		
Vera C.	11/10/11		
Dorothea D.	11/12/11		
Helen H.	11/21/11	+	5/../11
Blanche O.	12/ 5/11		
Stella H.	12/ 7/11		
Vernita B.	12/11/11	+	6/../09
Gladys D.	12/21/11		
Helen J.	1/ 2/12		
Mrs. C.	1/ 4/12		
Olive S.	1/16/12		
Constance P.	1/30/12		
Blanche O.	2/ 1/12		
Helen McD.	2/ 4/12		
Kathleen D.	2/14/12		
Irene B.	2/21/12	+	08
Louis D.		+	5/../10
Leslie V.	3/ 8/12	+	8/12/12
Charlotte J.	3/18/12	+	11/../08
Ruth N.	4/ 4/12		
Edna S.	4/ 9/12		
Hattie L. Taken 4/12.			

Sister developed scarlet fever April 27, 1912.

HOOSIER SCHOOL MASTER

S.	2/ 4/11		
Bessie V.	2/ 7/11		
Gale F.	2/21/11		
Mable B.	3/10/11		
Carroll S.	3/20/11		
Miss M.	3/31/11		
Country	4/12-26/11		
Eva B.	7/25/11	+	10/../09
Harrold S.	8/ 9/11	+	7/16/10
Mary B.	9/ 5/11		
Ellen A.	10/ 5/11	+	09
Dorothy A.	10/11/11		
Linas McC.	10/26/11	+	
Byron L.	10/29/11	+	09
Colt D.	11/15/11		
Francis P.	11/21/11		
George B.	12/ 1/11		
Grace J.	12/13/11	+	
J. B. S.	12/23/11		
H.	1/28/12		
Helen McD.	2/25/12		
Kenneth W.	3/ 4/12		
Mary Louise J.	3/23/12		
N.	4/28/12		
C. Taken 4/29	5/13/12		

Scarlet fever developed May 6, 1912.

CROWDED OUT O' CROFIELD

Edwin S.	5/ 9/11		
David L.	5/10/11		
Eva B.	5/21/11	+	10/../09
John E.	7/28/11		
Charles R.	8/ 7/11		
Lizzie O.	8/11/11		
Dorland B.	11/10/11		
Dorene S.	4/ 3/12		
C. Taken 5/4	5/18/12		

Scarlet fever developed May 6, 1912, in one child in the family.

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ABSTRACT OF DISCUSSION

DR. C. E. FORD, Cleveland: We are sending the books from given cases of communicable disease to the appropriate ward in the hospital for contagious diseases. We find that a fairly satisfactory way of avoiding the burning of books. If we get a book in a scarlet fever case, it is sent to the scarlet fever ward, sprayed with formaldehyd and wrapped with paper for safety during transportation.

DR. JOSEPH GOLDBERGER, Washington, D. C.: We very frequently have observations of a positive nature; that is, observations showing the apparent transmission of communicable diseases by fomites, such as books. The trouble with all such observations is that it is almost impossible to exclude other modes of transmission than those alleged in the particular instance. In cases such as reported by Dr. Nesbit we have negative results; and although the observations may by some be regarded as relatively few, it is nevertheless perfectly safe to conclude, even if they were much fewer in number, that in those instances no transmission actually took place. And this is a very much better thing than to be told that in one or two instances, perhaps a dozen, or even two hundred, or a thousand, or six thousand, transmission apparently took place, but where, as a matter of fact, absolute exclusion of other sources of infection could not be made. I think the observations reported are of such high significance that one cannot emphasize their value too much.

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INTESTINAL ANTISEPSIS *

NORMAN M. HARRIS, M.B.
CHICAGO

Any rational conception of the possible control of bacterial activities in the intestinal tract took its rise after the thorough establishment of bacteriology on a sound working basis by Robert Koch through his investigations on anthrax, tuberculosis and cholera.

It was well known through the early publications of Woodward, Nothnagel, Uffelmann, Escherich and others[1] that under the microscope the feces consisted in large measure of bacteria, although the estimates made were exaggerated. From these observations, the theory of intestinal auto-intoxication, or stercoremia, developed greater impulse which led to more wide-spread practical investigation of drugs of known antiseptic properties.

The foundation for all future work on the bacteriology of the intestinal tract was carefully and broadly laid by Escherich[2] in 1886 in his profound studies of the stools of suckling infants. He it was who first realized how relatively small the numbers of cultivable bacteria are in the feces compared with the host seen in a stained preparation. Whether all these non-cultivable forms one sees are actually dead, or only such as do not find our mediums suitable for growth, cannot be arbitrarily decided one way or the other; it is most reasonable to suppose, however, that they are made up of both sorts in unknown proportions, most authorities favoring the idea

* This research was conducted under a grant made by the Therapeutic Research Committee of the Council on Pharmacy and Chemistry of the American Medical Association.

1. Cited by Strasberger, Ztschr. f. klin. Med., 1902, xlvi, 413.
2. Escherich: Die Darmbakterien des Säuglings, Stüttgart, 1886.

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that the dead ones chiefly predominate. Whatever be the proportions, they are frequently spoken of together as the "non-viable" bacteria in contradistinction to those which can be cultivated and termed the "viable" bacteria. Many attempts have been made to give expression in figures of the average content of viable bacteria in the stools of normal adults on a general diet; but so many variables have to be taken into account that it is not astonishing that the numbers published vary greatly. Sucksdorff,[3] examining his own stools over a period of twenty-four days, using nutrient gelatin as culture medium, found the count to vary from a maximum of 2,300,000 per mg. to a minimum of 25,000; he judged that 381,000 was expressive of an average per milligram. Gilbert and Dominici[4] obtained 67,000 per mg.; Casciani[5] 16,000 per mg., and Matzuschita[6] 18,000,000. MacNeal, Latzer and Kerr,[7] examining the stools of twelve healthy men in an exhaustive manner found numbers to vary between a maximum of 1,526,140 bacteria per mg. and a minimum of 1,360, with a mean of 116,239. Some have tried to establish a numerical ratio between the viable and non-viable bacteria, by a combination of counting organisms in a stained smear and cultural tests carried out under the most favorable conditions. Eberle[8] believed that from 4.5 to 10.6 per cent. were viable; while A. Klein,[9] coining the term "sterility index" to express this relationship, made it about 1 per cent. Schmidt and Strasberger[10] state that the foregoing figures are too high and affirm that 0.07 per cent. is much closer to actual conditions; they also have calculated by special procedure that a healthy adult excretes each day about 8 gm. (dried

3. Sucksdorff: Arch. f. Hyg., 1886, iv, 355.
4. Gilbert and Dominici: Compt. rend. Soc. de biol., 1894, pp. 117, 277.
5. Casciani: Deutsch. med. Wchnschr., 1897, p. 297.
6. Matzuschita: Inaug. Dis., Halle, 1902.
7. MacNeal, Latzer and Kerr: Jour. Infect. Dis., 1909, vi, 123, 571.
8. Eberle: Centralbl. f. Bakteriol., 1896, xix, 2.
9. Klein, A.: Centralbl. f. Bakteriol., I, 1900, xxviii, 834.
10. Schmidt and Strasberger: Die Faeces des Menschen, Berlin, 1905, Ed. 2.

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weight) of bacteria, equivalent to 128,000,000,000,000. MacNeal, Latzer, and Kerr,[7] after examining 204 stools of twelve men on mixed diet by the same method, obtained an average of 5.34 gm., and Mattill and Hawk[11] by a somewhat different process express this daily output as 8.27 gm.

A great deal of laborious work has been performed in isolation and description of viable species, both aerobes and anaerobes, notably by Escherich,[2] Schild,[12] Matzuschita,[6] Tissier,[13] Moro,[14] Ford,[15] and many others. As one might expect, the number of species is relatively large; doubtless certain organisms have been discovered and described many times by different observers, thus leading to some confusion.

Classification, too, of the intestinal bacteria is by no means yet in any entirely satisfactory state, unanimity of opinion being lacking. Professor Theobald Smith[16] has said: "It is what bacteria do, rather than what they are, that commands attention." In conformity with this idea, there has just appeared a very logical classification by Distaso,[17] one of Metchnikoff's pupils, one which I cannot forego quoting, based as it is broadly on Metchnikoff's view[18] of the very great importance of the indol-forming bacteria.

A. Non-indologenous bacteria:
   1. Amylolytic;
   2. Saccharolytic: (*a*) acetogenous; (*b*) lactic; (*c*) bacteria of miscellaneous and inconstant activities.
   3. Asaccharolytic: (*a*) peptolytic; (*b*) gelatinolytic.

B. Indologenous bacteria:
   1. Amylolytic.
   2. Saccharolytic: (*a*) peptolytic; (*b*) gelatinolytic.
   3. Asaccharolytic: (*a*) peptolytic; (*b*) proteolytic.

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11. Mattill and Hawk: Jour. Exper. Med., 1911, xiv, 433.
12. Schild: Ztschr. f. Hyg., 1895, xix, 113.
13. Quoted by Moro: Jahrb. f. Kinderh., 1905, lxi, 687, 870.
14. Moro: Jahrb. f. Kinderh., 1905, lxi, 687, 870.
15. Ford. Studies, Roy. Victoria Hosp., Montreal, 1905, Path. II, 1, No. 5.
16. Smith, T.: Am. Med., 1904, viii, 711.
17. Distaso: Centralbl. f. Bakteriol., I, 1912, lxii, 433.
18. Metchnikoff: Ann. de l'Inst. Pasteur, 1910, xxiv, 755.

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FLORA OF THE INTESTINAL TRACT

The bacterial inhabitants of the intestinal tract are loosely spoken of as the "flora" of the tract, despite the fact that some are mere "birds of passage" while others may be looked on as steady tenants. Attention has of late been sharply called[19] to the impropriety of speaking of the flora of the stomach, duodenum, jejunum or upper two-thirds of the ileum, because in health and between the intervals of digestion these localities are practically sterile. With the large bowel the reverse is the case, and we may with perfect propriety speak of its having a definite and continuous flora. In this organ we have always present such active indologenous bacteria as *Bacillus coli, B. proteus, B. cloacæ, B. subtilis,* Welch's bacillus, *B. putrificus coli, B. sporogenes,* and some staphylococci.

Bacterial activity, although present in the chyme as it leaves the stomach, does not reach its maximum until the contents of the small intestine are discharged into the cecum and large intestine. Here any unabsorbed products of digestion, or undigested protein or carbohydrate are attacked immediately. The raw protein and aminobodies are broken down further and we have the production of aromatic oxacids, indol, skatol, phenol, ptomains, hexone bases, mercaptan, hydrogen sulphid, etc. The most dangerous of these Metchnikoff[18] declares are the indol and phenol bodies, which by slow and continuous absorption give rise to the symptoms of auto-intoxication and ultimately to the scleroses of the arteries and other organs of the body. A discussion of this whole subject is admirably presented by Herter.[20] Direct experimental evidence of the constitutional effects of the indologenous bacteria in monkeys and cats fed on a rich protein diet have been described by Herter and Kendall.[21] They also demonstrated that by altering the diet to a carbohydrate

19. Medowikow: Arch. f. Kinderh., 1910, liv, 307. Wollmann: Ann. de l'Inst. Pasteur, 1910, xxiv, 807.

20. Herter: Common Bacterial Infections of the Digestive Tract, New York, 1907.

21. Herter and Kendall: Jour. Biol. Chem., 1909-10, vii, 203.

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one the symptoms of auto-intoxication cleared up because of the regimen cutting down the indol and phenol activities of certain bacterial species. Recently, Kendall[22] has put these experimental observations on dietary control into practice, with very gratifying results.

It would occupy too much time to go into any of the details of experiments dealing with life under amicrobic conditions; it is sufficient to say that the fundamental results obtained by Nuttall and Thierfelder,[23] who declared that the presence of bacteria was inessential to warm-blooded animals, as the natural digestive juices were of themselves amply sufficient to reduce foodstuffs of a protein-carbohydrate diet, have been amply confirmed by Cohendy[24] working with chicks.

That Nature herself makes an effort to keep a portion, at least, of the gastro-intestinal tract free of bacteria has been well known for some years past, although attempts to explain this "self-sterilization," as Kohlbrugge[25] termed it, have not been at all entirely satisfactory. (A very full discussion of this topic is given by Medowikow,[26] Wollmann,[19] and Lindemann.[27]) Briefly stated, it would appear that the absolute or relative sterility depends on a conjunction of several factors, namely, hydrochloric acid in the gastric secretion, bactericidal substances in the secretion apart from hydrochloric acid, bactericidal substances in the succus entericus, particularly stimulated by the passage of fat (Medowikow), mechanical action of the mucus, peristalsis, and the action of the bacterial products of some species having a retarding action on other species. Medowikow states that this bactericidal substance of the gastric juice and succus entericus may not be effectively secreted through the evil effects of overfeeding, starvation, excessive hemorrhage, exposure to great heat, insolation, or to any cause pro-

22. Kendall: Boston Med. and Surg. Jour., 1911, clxiv, 288.
23. Nuttall and Thierfelder: Ztschr. f. physiol. Chem., 1895-96, xxi, 109; 1896-97, xxii, 62; 1897, xxiii, 231.
24. Cohendy: Ann. de l'Inst. Pasteur, 1912, xxvi, 106.
25. Kohlbrugge: Centralbl. f. Bakteriol., I, 1901, xxix, 571.
26. Medowikow: Arch. f. Kinderh., 1910, liv, 307; 1911, lv, 214.
27. Lindemann: Inaug. Diss., Bonn, 1909.

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moting irritation of the mucous membrane of the tract. Surgically this self-sterility of the upper portion of the intestinal tract is of the highest importance, as early pointed out by Cushing and Livingood,[28] who also recommended the feeding of sterile food previous to operations in upper reaches of the tract.

INTESTINAL ANTISEPSIS

In considering any possibility of effecting antisepsis or sterilization of the digestive tract, we have to bear in mind certain definite facts: (1) as regards the tract itself; (2) the choice of the agent to be administered; (3) the technical methods to be employed in reaching results; (4) the interpretation of results.

1. The Digestive Tract.—The tract itself must not be regarded as a dead unresponsive tube 25 or 30 feet in length, but as a living, independently reacting organ which responds in a variety of ways to the entrance of foreign materials. Particularly must be considered its liability to irritation by the use of medicaments possessed of antiseptic qualities, whereby may be directly aided the continued multiplication of the very microbes we wish to subdue. The rapid absorptive power of the mucous membrane may become active in the case of certain agents by rapidly removing them from the field of action, and possibly exerting a harmful action on the body as a whole. Then also the antiseptic agent may be split up through the action of the digestive and intestinal juices and no benefit accrue from its administration; or the drug may combine with the elements of the chyme and be rendered inert.

2. Choice of Antiseptic.—The choice of a practical antiseptic agent has been lucidly set forth by Assmann[29] as follows:

A. It should have a strong germicidal action.

B. It should be relatively non-toxic for the body as a whole, and harmless to the intestinal mucosa.

28. Cushing and Livingood: Contributions to the Science of Medicine by the Pupils of William H. Welch, Baltimore, 1900.
29. Assmann: Ztschr. f. Tiermed., 1911, xv, 122, 264, 352.

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C. It should be absorbed in small amount.

D. It should suffer no chemical changes whereby it loses any of the above requirements (A-C).

E. It should be so constituted that it mixes freely with the intestinal contents, and therefore be freely soluble.

To these conditions the following might be added:

F. It should be one that acts throughout the whole length of the tract.

3. Technical Methods.—For antiseptic studies on the feces, we have at our disposal the usual plate-culture method with or without the use of special mediums, the direct counting method of Klein[6] as modified by Hehewerth,[30] or that used by MacNeal, Latzer and Kerr,[7] and the centrifugal separation and weighing method of Strasberger.[1]

In criticism of these methods, it may at once be stated that in itself each is an imperfect method for furnishing entirely reliable results.

If we employ the cultural method, it must be borne in mind that any one medium that we elect to use cannot be suitable to meet the growth requirements of *all* viable species. In the next place, given a medium of preference, we have to reckon with bacterial antagonisms which may materially influence the count. Also some have conceived that a sufficient amount of the antiseptic agent may be carried over into the culture medium and suppress growth of some bacteria. Then on account of variation in technic of different workers it is difficult to draw comparisons of results; adequate standard methods are therefore urgently required. Lastly, not all bacteria grown out necessarily bear any direct relation to putrefactive processes. But at this point, one overpowering advantage that the cultural method has over its competitors is that by further analysis we may be able to determine the presence of indologenous types and so judge directly of the value of the antiseptic drug employed.

30. Hehewerth: Arch. f. Hyg., 1901, xxxix, 321.

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The counting method of Klein and Hehewerth, although most carefully elaborated, has within it certain defects that can be productive of only very approximate figures, and in unskilful hands would be entirely untrustworthy. Briefly the method is as follows: At least 10 gm. of feces are to be rubbed up thoroughly in a mortar with 100 c.c. of distilled water; 10 c.c. of this mixture are placed in a flask containing glass beads with a measured quantity of water, such that every 10 c.c. of the contents will hold from 35 to 40 mg. of feces in suspension. The flask is to be thoroughly shaken to break up fecal masses and bacterial clumps, then 1 c.c. is taken and a similar quantity of anilin gentian-violet added, and after standing from three to four minutes is again shaken, and one standard platinum loopful is smeared out quite evenly over a perfectly grease-free cover-slip and dried and mounted in balsam. The bacteria in fifty fields of the one-twelfth inch oil-immersion lens are to be carefully counted. Then with care, the result is to be reckoned on the basis of the amount taken up by the loop, the area of the cover-glass, the size of the microscopic field and the ultimate dilution of the original fecal mass. Then by a culture check, Klein establishes what he calls the "sterility-index" of the fecal sample, that is, the ratio of the living to the dead or non-viable bacteria. The disadvantages are obvious; a loopful is a most variable quantity although taken up by the same person over and over again; to spread a film uniformly and evenly with a loopful of fluid is impossible; the bacteria in fifty fields constitute only a minimal number, and clumps and chains must occur; finely divided foreign matter may be mistaken for microbes; and taken by itself, like any other purely mechanical procedure, it can yield no information regarding what the bacteria are, or what they can do. Less objectionable, but more difficult, is MacNeal's method of adapting the Thoma-Zeiss blood-counting apparatus to the enumeration of bacteria in the stool.

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The most popular method of to-day is that of Strasberger, the centrifuging and weighing method of determining the bacterial content of the stool, which I have used. And as it has formed the basis of several inquiries into the action of so-called intestinal antiseptics, and has been employed in my own investigations, I may be pardoned for speaking of it at some length.

As modified slightly by Ehrenpfordt[31] and accepted by Strasberger, the technic of the examination of a stool is as follows: The whole stool is received in a sterile receptacle, and, unless fluid, to it is added a definite quantity of sterile water and the whole rubbed up to ensure thorough integration. Two c.c. are taken and set aside for drying and weighing; 2 c.c. more are removed to a 50-c.c. centrifuge glass; 30 c.c. of a 0.5 per cent. solution of hydrochloric acid added and carefully rubbed up and admixed. The tube is put in an electric centrifuge and whirled for five minutes at 1,500 revolutions per minute; this throws down all coarse foreign matter, leaving the bacteria and any finely divided débris in the supernatant fluid, which is then pipetted off into a beaker. Thirty c.c. more of the acid solution are added, and the process repeated until the supernatant fluid becomes clear to the naked eye, when it is taken for granted that all or nearly all bacteria are removed. The collected fluid is again centrifuged to throw down any débris accidentally taken up before, the sediments are again washed and the washings collected and added to the bacteria-holding fluid. An equal volume of 95 per cent. alcohol is now added to the bacterial suspension in the beaker and the latter is placed for twenty-four hours on a water bath at 40 C. to evaporate. Further alcohol is then added and the whole centrifuged; the sediment now consists of bacteria, which are then collected, washed in absolute alcohol, then in ether to remove fats and lipoids, then washed out of the centrifuge tube with absolute alcohol into an evaporating dish of known weight, put on

31. Ehrenpfordt: Ztschr. f. exper. Path. u. Therap., 1910, vii, 455.

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a water-bath to drive off the alcohol, transferred to a desiccator for twenty-four hours and finally weighed. The result is expressed either in terms of total output per day, or more commonly in terms per cent. of dried bacteria to total stool reckoned as dried. This method, like the preceding, gives no information concerning the bacteria themselves or their functions.

As Strasberger himself declares, the method gives only approximate results, and in the hands of one individual fairly comparative results; but in the hands of different workers, results when compared together vary in an amazing degree. For instance, using the original Strasberger technic, or some slight modification of it, the values expressive of the percentage relationship of dried bacteria to dried stool of normal persons on a mixed diet as found by different workers are given in the accompanying tabulation:

RELATIONSHIP OF BACTERIA TO STOOL, FOUND BY STRASBERGER TECHNIC

Investigator	Relationship, Per Cent.
Strasberger	24.3
Schittenhelm and Tollens**	42.0
Lissauer *	8.67
Tobaya †	11.2
Sato ‡	24.39
Berger and Tsuchiya	12.6
Steele	18.1
Friedenwald and Leitz§	16.87
MacNeal, Latzer and Kerr	26.9
Mattill and Hawk	27.95
Harris	9.18

** Schittenhelm and Tollens: Zentralbl. f. inn. Med., 1904, xxv, 761.

* Lissauer: Arch. f. Hyg., 1906, lviii, 136.

† Tobaya: Quoted by Sato

‡ Sato: Ztschr. f. exper. Path. u. Therap., 1910, vii, 427.

§ My calculation.

Obviously, such marked variations in results are rather startling and weaken one's faith in the efficiency of this method. Ehrenpfordt[31] remarks in his criticism of the method that there must remain in suspension with the bacteria bodies whose absolute weight is greater, but which, on account of their larger surface, offer greater resistance to the precipitating force and thus remain sus-

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pended. If the force of centrifugation is increased, these bodies will be ultimately precipitated, but so also will large numbers of bacteria. Undoubtedly also, foreign substances which are of absolutely greater weight, but which, on account of being in a state of fine subdivision, are relatively of the same weight as the bacteria, will also remain suspended, and so be carried over continuously and introduce error into the final result. Strasberger himself pointed out that certain amounts of soluble nucleoprotein may always be carried over. Berger and Tsuchiya[34] made a series of tests and found that this nucleoprotein ran from 0.2 to 0.9 parts per thousand in the feces in normal conditions, and might in catarrhal conditions reach as high as 3.8. Ehrenpfordt considers that this substance constitutes a negligible error, as much of it is washed away in the process of centrifugation.

Probably one factor stands out preeminently as a source of error and that is the value of the judgment of the operator in interpreting the clarity of the supernatant fluid, for this constitutes a critical point. In his original paper Strasberger was content to cease washing the fecal sediment when the supernatant fluid remained "moderately clouded" (*mässig getrübt*), a condition which allowed a tremendous degree in latitude of interpretation. Even when "clear" to the naked eye, the fluid may still contain considerable bacteria, and the sediment an abundance of them. I have taken in my work an index of clarity to mean not more than an average of 15 bacteria per field of the one-twelfth inch oil-immersion lens when one 1.5-mm. loopful of fluid removed by a pipet from the central part of the tube is dried on a slide without spreading. The pipet should be carefully wiped and the first drop discarded lest a slight surface film (of fat and bacteria) adhere to it on withdrawing the pipet from the centrifuge tube. One can never free the sediment of bacteria, and the number remaining undisengaged when the supernatant fluid is clear varies tre-

34. Berger and Tsuchiya: Ztschr. f. exper. Path. u. Therap., 1910, vii, 437.

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mendously, in spite of continual rubbing up of it at the end of each centrifugation. The second great cause of error, the admixture of particulate foreign matter, cannot be dealt with successfully by a second centrifugation. I have attempted to overcome this by slowly filtering the collected supernatant fluid through wet absorbent cotton (from 4 to 5 sq. cm.) packed not too tightly in the bottom of a funnel 6 cm. in diameter. The cotton is afterward removed, its retained fluid squeezed out into a centrifuge tube, and then it is torn up into small fragments, cast into the tube, 40 c.c. of the acid solution added and the whole shaken violently for two minutes. The cotton is next to be removed and squeezed dry, and the tube is then whirled for five minutes at 1,500 revolutions per minute, its contents added to the general collection, and the resulting sediment again washed until the fluid remains unclouded.

Some operators say that the feces ought not to take more than 300 c.c. to complete the washing of the sediment "clear"; I have never succeeded in doing it with less than 600 c.c. and on an average 1,000 c.c. Further, it is quite impossible to precipitate the bacteria from the alcoholic solution in five minutes at 3,000 revolutions per minute, which Ehrenpfordt states is all that is necessary. With the suspension containing from 60 to 70 per cent. of 95 per cent. alcohol, it consumes, in my hands, one hour and a quarter before the "clarity index" is reached, using a centrifuge with a 15 cm. arm-radius and running at 3,000 revolutions per minute.

As a result of my investigation, I am of the opinion that if workers in this country, at least, are to continue using the method, some endeavor ought to be made to unify or standardize the technic; otherwise interlaboratory results cannot be considered comparable.

4. Interpretation of Results.—Considering the merits, then, of these three methods used as indexes for interpretation of results, I am fully convinced that the cultural method in the hands of the thoroughly initiated

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affords us data of such value that no mechanical method, dealing only with biologically inert matter, can give. One *must* know what these bacteria are, where they come from, what they do chemicobiologically, and how they are influenced by intestinal medication; and one other point in favor of the biologic method is its relative freedom from technical details, which comparatively results in a great saving of time and enables us more extensively to cover the field of investigation. It may be stated here in this connection that a single Strasberger examination cannot be completed under five days of continuous work —Mattill and Hawk mention seven—nor can one person take care of more than two stools per day with convenience.

PREVIOUS WORK

Probably Bouchard[35] more than any other is to be regarded as the pioneer in intestinal antisepsis. He drew attention to the chain of symptoms grouped under the names "auto-intoxication" or "stercoremia" and he attempted to prove that the urines in such cases were possessed of peculiar toxic principles conferred on them by absorption of putrefactive bacterial compounds from the intestinal tract. Attempts were made by him to lessen putrefaction by administering charcoal, naphthalin and iodoform internally. Baumann,[36] using the method for the determination of the ethereal sulphates in the urine as the gauge of absorption of putrefactive substances, was probably more responsible than any one else in putting calomel so high in the list of the so-called intestinal antiseptics, a place it has no right to hold based on any distinct antiseptic action. Morax[37] repeated Baumann's experiments and concluded that calomel acted in reducing ethereal sulphates not by any antiseptic action on intestinal bacteria, but by removing their putrefactive products rapidly from the bowel through active peris-

35. Bouchard: Lecons sur les autointoxications dans les maladies, Paris, 1887.
36. Baumann: Ztschr. f. physiol. Chem., 1886, x, 123.
37. Morax: Ztschr. f. physiol. Chem., 1886, x, 318.

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talsis. F. Müller[38] demonstrated that by increasing the carbohydrates of the food, indoxyl could be completely removed from the urine. Biernacki[39] amply confirmed Morax's observations, and showed that a milk diet was quite as effectual as calomel in lowering the ethereal sulphates. Fürbringer[40] placed no faith in calomel or naphthalin in cutting short the clinical course of typhoid fever; nor by culture methods was he convinced that either of them had any influence in reducing the numbers of the bacteria present in the stools. Stern[41] demonstrated culturally that *B. prodigiosus* introduced into the canal along with the food was not restrained at all appreciably by calomel. Schütz[42] proved conclusively that *Spirillum metchnikovii,* which ordinarily succumbs in the dog's intestine, appears in a viable condition in large numbers following the administration of calomel. Evidence given by the Strasberger weighing method, in the hands of its author[1] and by Feigen[43] demonstrates that the bacterial output is markedly increased above the normal (from three-fourths to two times). On the other hand, Berger and Tsuchiya[34] found a slight reduction in the bacterial output.

A great array of other drugs has been tested culturally, and reports pro and con have been expressed by the authors. For instance, Sucksdorff[3] claimed to have obtained a drop of one-third in numbers of colonies in his own stool after taking 3.6 gm. of quinin in divided doses; and even a more marked drop followed the administration of 2.1 gm. naphthalin. Kumawaga,[44] using 14 gm. acetanilid, U. S. P., on a dog, reported a reduction of colonies to the proportion of thirty-seven to one. Salkowski[45] got a considerable reduction of bacteria in the feces of a dog fed at intervals with chloroform water.

38. Müller: Mitt. a. d. Würzburger Klinik, 1886, ii, 352.
39. Biernacki: Deutsch. Arch. f. klin. Med., 1892, xlix, 87.
40. Fürbringer: Deutsch. med. Wchnschr., 1887, xiii, 209, 235, 257.
41. Stern: Ztschr. f. Hyg., 1892, xii, 88.
42. Schütz: Arch. f. Verdauungskr., 1901, vii, 43.
43. Feigen: Inaug. Diss., Bonn, 1908, p. 39.
44. Kumawaga: Virchows Arch. f. path. Anat., 1888, cxiii, 134.
45. Salkowski: Virchows Arch. f. path. Anat., 1889, cxv, 339.

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Stern[41] found no effect following naphthalin, betanaphthol, salol and camphor. Von Mieczkowski[46] in cases of ileocecal fistula tested the antiseptic values of bismuth, silver citrate, tannopin, betanaphthol and menthol by mouth. With the exception of menthol, his results were of no value; in the case of the latter there appeared to be a substantial reduction following the giving of such amounts as from 10 to 13 gm. in divided doses. As late as last year, Assmann[29] reported negatively on guaiacol cinnamate (styrakol), tanninformaldehyd (tannoform), tribromphenol-bismuth (xeroform) and bismuth subgallate, using the culture method to gauge results. He employed dogs fed on milk-rice and meat-rice diets. In the same manner he tried the effects of two different silver-protein solutions (so-called "colloidal" silver solutions), which had been superficially tested by Klimmer[47] in 1900. If given in a solution of gum acacia along with the food, the results proved encouraging as the colonies per milligram of feces fell at times quite low. In the giving of colloidal silver preparations to man, it ought to be borne in mind that absorbed silver might be ultimately in part laid down in the skin. In the dog, Klimmer states that absorbed silver is laid down in the intestines, liver and spleen, but *not* in the nervous system, muscles, ligaments or skin; in the dog the skin is devoid of sweat-glands and this may be sufficient explanation why no silver is deposited there.

By the Strasberger technic the following agents have been literally "weighed in the balance and found wanting": naphthalin, thymol, silver citrate, betanaphthol and salicylic acid (doubtful), by Strasberger,[48] magnesium dioxid and iodo-anisol by Feigen;[43] in cases of intestinal catarrh, negative results were obtained by Friedenwald and Leitz[49] using salicylate of bismuth,

46. Mieczkowski: Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1902, ix, 405.
47. Klimmer: Ztschr. f. Tiermed., 1900, iv, No. 4.
48. Strasberger: Ztschr. f. klin. Med., 1903, xlviii, 491.
49. Friedenwald and Leitz: Am. Jour. Med. Sc., 1909, cxxxviii, N. S., 653.

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salol potassium guaiacol-sulphonate (thiocol), acetyl-salicylic acid (aspirin) and thymol; while favorable results with bichlorid of mercury and ichthyol albuminate (ichthalbin) were noted; but the sharpest fall in bacterial excretion was obtained in a case of intestinal catarrh with hyperacidity when the patient was simply put on a change of diet! Berger and Tsuchiya[84] report a lessened bacterial output by the use of a patented preparation of agar-agar and hydrogen dioxid. Steele[50] found that in normal persons the administration of betanaphthol and bismuth salicylate caused a slight fall in the bacteria excreted.

AUTHOR'S WORK

My own work on which I shall now briefly report was undertaken at request of the Council on Pharmacy and Chemistry with the object of testing the combined values of methods and drugs in this very doubtful field of intestinal antisepsis. On account of the rather limited time at my disposal, a series of unlooked-for interruptions and the length of time required in making analyses, the results are not so extensive as might be wished for, but they have been to me very illuminating and valuable.

The investigation naturally enough fell into two parallel lines of work, the one an application of the Strasberger technic; the other a bacteriologic inquiry used as a check or control on the first. The drugs tested were salol, betanaphthol and guaiacol carbonate. Three cases were used for the development of the Strasberger technic, and when that was acquired, six more furnished the real basis for inquiry. None of these persons suffered from intestinal disturbances. All were put on the well-known Schmidt-Strasberger diet, consisting of toast, milk, eggs, butter, potatoes, meat and oatmeal gruel in proper balance and sequence. The use of this diet insures a stool of constant quality and one easily worked up in the laboratory. The diet has one drawback, namely, that of being tasteless and not appetizing enough, so that it is

50. Steele: Jour. Med. Research, 1908, xiii, N. S., 98.

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difficult to keep some persons on it a sufficient length of time to obtain results; others reject it at the end of a day or two. The bacteriologic mediums employed for plating purposes consisted of nutrient gelatin, 12 per cent., and 0.7 per cent. acid to phenolphthalein; and of a gelatin dextrose agar of the following composition:

Gelatin	20.0
Agar	17.5
Peptone (Witte)	10.0
Dextrose	1.0
Meat infusion	1,000.0

Reaction, 0.7 per cent. of normal hydrochloric acid, phenolphthalein being the indicator.

Half a gram of feces was always accurately weighed out for the centrifugation process, and 1 gm. for the bacteriologic examination. The gelatin plates were left at room temperature (15 to 23 C., depending on seasonal and steam-heat alternations) for at least five days; the agar-cultures were grown for the most part at 37 C. for forty-eight hours, and less frequently for seventy-two hours; the extra day of incubation did not affect the count sensibly, if at all.

The bacterial species predominating were *B. coli* and streptococcus, the former in greatly preponderating numbers, except in one case in which the species were in reverse order. *B. lactis aerogenes* was met with in few numbers in two cases; *B. cloacæ* in one; *B. coli anaerogenes (?)* in one; an undetermined yellow coccus in one; and *Staphylococcus albus* in another case; neither *B. proteus* nor any spore-bearing aerobe was found. Anaerobic tests were not carried out as a routine measure, as time was not available. Three tests were made for the presence of spores of Welch's bacillus (*B. aerogenes capsulatus*), and in each case positive cultures were obtained with 0.1 c.c. and with two loopfuls (1.5 mm. diameter) of a one-tenth dilution of the fecal sample, thus proving a relative abundance of viable spores of this organism in each stool.

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The counts obtained in all the cases showed a variation within the bounds recognized as normal, and no evidence of an acceptable reduction in numbers ascribable to any antiseptic action of the agents employed was recognized.

Each agent was given to two patients, respectively, in six divided doses: salol 6 gm., beta-naphthol and guaiacol carbonate 4 gm., and with the first and last dose of each, a capsule containing 0.3 gm. of powdered carmin to indicate the visible limits of drug distribution and action.

With the Strasberger tests, the results expressed in percentage relation of the dried bacteria to the dried stools showed with salol tests: (1) an increase from 7.5 to 18.5 per cent.; (2) a fall from 9.4 to 2.7 per cent. Betanaphthol tests gave: (1) a rise from 4.5 to 5.1 per cent.; (2) a rise from 18.5 to 23.1 per cent. Guaiacol carbonate indicated: (1) a rise from 23.3 to 27.6 per cent.; (2) no reliable figure was obtained on account of a large mixed stool being passed following administration of a vegetable purgative (aloes and cascara) to overcome obstinate constipation. The value for this mixed stool was 14 per cent., while the values for the next three stools ran from 12.9 to 22.8 per cent. Time did not permit of running another guaiacol carbonate test.

In most instances the indican in the urine was followed daily by qualitative tests only. It was noted that as a rule less was apparent following the administration of the antiseptic, but inasmuch as the indol content of the stools was not followed, the value attached to such observations is considerably lessened.

In so far as figures go (see table), mine do not go to prove that any of the antiseptic agents employed exerted any beneficial action. In the bacterial count, such variations as occur indicate nothing more than what might be found in running a series of daily counts on an individual over a period of several days. This is shown by Sucksdorff; in an investigation of over twenty-four days on one individual the figures varied from a maximum to a minimum a little over ninety times. The greatest vari-

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RELATIONSHIP OF BACTERIA TO STOOL, FOUND BY STRASBERGER TECHNIC (AUTHOR'S FINDINGS)

SALOL TEST

Patient	Date	Drug Dosage	Feces		Bacteria		Colonies in Millions, Per Gram	Indican in Urine	Appearance of Carmin Indicator
			Total Moist	Total Dried	Total Dried	Per Cent. Relation			
Rb.	3/ 4 /12	0	130	9.3	0.7	7.54	167	+++	0
	3/ 8 /12	6.0	390	101.79	4.13	4.06	53	+	0
	3/ 9 /12								
	3/10/12	0	165	34.48	6.4	18.56	110	+	+++
Mt.	3/ 7 /12	0	785	†	†		150	+++	0
	3/ 8 /12	6.0	0						
	3/ 9 /12		205	26.65	2.62	9.41	840	++	0
	3/11/12	0	650	131.49	3.64	2.76	820	++	+++
				BETANAPHTHOL TEST					
Ma.	3/25/12	0	140	28.89	1.31	4.55	30	—	0
	3/26/12	4.0	80	†	†		120	—	0
	3/27/12		185	42.60	2.14	5.02	34	—	0
	3/28/12	0	40	4.40	0.28	6.54	460	—	+++
	3/29/12	0	175	31.90	1.65	5.19	214	—	+++
	3/30/12	0	180	27.88	3.09	11.1	87	—	0

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Ro.	4/27/12 4/28/12	4.0	320	77.08	14.27	18.51	320	+	0
	4/29/12	0	185	12.32	2.84	23.11	700	+++	+++
	5/1/12	0	‡	‡					
	5/2/12	0	235	8.15	2.39	29.41	10	+	0
	5/3/12	0	155	14.38	2.17	15.09	37	+	0
				Guaiacol Carbonate Test					
Zm.	4/27/12 4/28/12	4.0	35	8.66	1.92	23.38	950	+++	0
	4/29/12	0	90	14.99	4.14	27.67	355	++++	+++
	4/29/12	0	150	12.46	3.18	25.44	85	0	+++
	*								
Kf.	5/6/12 5/7/12	4.0	‡	‡					
	5/9/12	0	345	84.73	11.86	14.00	500	+++	+++
	5/10/12	0	100	14.97	1.94	12.95	540	+	0
	5/11/12	0	160	38.24	3.77	9.84	670	+	0
	5/14/12	0	180	22.19	5.07	22.87	30	+	0

* Further observations impossible, as patient was transferred to surgical ward. † No determination. ‡ Stool lost. — No test.

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ation of colonies in my tests is shown in Patient "Ro" (betanaphthol) in whose case the figures sank from 700 in the medicated stool to ten in the one following, which was not exposed to the action of the drug. It is obvious, too, that the figures obtained by the Strasberger technic show nothing favorable to the action of the drugs, using either the absolute daily bacterial output or the percentage relationship of dried bacteria to dried stool as bases of comparison.

To generalize seriously from the very small number of experiments would be unwise, but so many have reported "favorably" on drug action based on really small falls in percentage relationship that I cannot refrain from pointing out what Strasberger[51] himself does not accentuate frankly in his first article dealing with the value of the technic, wherein in one and the same person (normal) in a series of fourteen counts the percentage relationship varied from 68.4 to 7.0, and in three cases the absolute output in three-day periods varied from 37.5 to 12.3 gm. MacNeal, Latzer and Kerr's experiments[7] show variations in twelve average percentages of 20.8 to 34.62 and in absolute output per day of 1.87 to 9.15. Hence I feel that if we are to accept results on the basis of figures alone, those obtained by the Strasberger technic are open as freely to criticism as are those obtained in the past by purely bacteriologic counts. So I believe that moderate falls in percentage relationship (which are usually obtained) may be expressive only of variations within the normal, and one must be extremely conservative then in arriving at any positive conclusion as to the effectiveness of any drug.

Moreover, were results trustworthy, can we by employment of this technic say what organisms are killed off, saprophytes from the contents of the small bowel, or parasites from the cecum or colon, indologenous or non-indologenous? We cannot. To-day as formerly we stand in need of a method which, aside from the production of

51. Strasberger: Ztschr. f. klin. Med., 1902, xlvi, 439.

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mere figures, can tell us what organisms we have to deal with, what their biochemical processes are, and how this or that drug is acting in reducing both numbers and species, and in what location in the tract reduction is effected. Such information can be obtained only from the application of modern ideas of biochemistry and pharmacy in conjunction with present-day bacteriologic knowledge and technic, and it will be along such lines that future progress will manifest itself.

In conclusion it may be said that in spite of so-called "favorable reductions" being obtained by any method whatsoever, our plate-cultures plainly inform us that antiseptic drugs fail to kill off per gram of feces, millions of indol-producing bacteria, whose habitat is the large intestine. When some agent is put into our hands that, acting particularly in the large bowel, can consistently reduce those millions to hundreds of thousands, and these to hundreds, we may begin to talk comfortably about the great value of this or that form of intestinal medication. And on the basis of evidence, we can still heartily agree with the remarks of Friedenwald and Leitz[49] who said that "regulations of diet, together with the evacuation of the bowels, is the most effectual method that we have at hand of reducing the excessively high bacterial content of the large intestine".

I wish to acknowledge the debt of gratitude I am under to Prof. Lewellys F. Barker, of the Johns Hopkins Hospital, Baltimore, and his several house officers and to Drs. Sellards and Austrian, who have by their kind services made this contribution possible.

ABSTRACT OF DISCUSSION

DR. GEORGE M. STERNBERG, Washington, D. C.: I think it extremely probable that the negative results from the use of the so-called intestinal antiseptics will by further researches be shown to be what might have been expected. Indeed, I have never had any especial faith in the use of intestinal antiseptics that have been proposed and largely used by the profession. I do not mean to say that they may not have had a valuable therapeutic effect, but that that effect was

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from destroying microorganisms in the intestinal canal I have doubted very much and this doubt is confirmed by the paper I have just heard.

DR. HORATIO C. WOOD, JR., Philadelphia: The effect of antiseptics in the colon seems to me to be a problem which is hardly worth the solving. As a practitioner of medicine I never expect to get any antiseptic action in the colon from an internal antiseptic. I think that is absolutely hopeless. What we want to do, if possible, is to find some drug which will influence bacterial multiplication in the upper part of the intestine.

DR. J. H. MASON KNOX, JR., Baltimore: What is the effect of lactic acid bacteria on the number of flora in intestinal content and is it lactic acid bacteria in the solid or the fluid form? Both are advocated, and, particularly, do these organisms have any effect on the presence or diminution of the number of dysenteric organisms which are sometimes found in infants' stools in warm weather?

DR. NORMAN M. HARRIS, Chicago: There was in the unread portion of my paper a reference to some recent work carried out by Assmann in Germany with certain colloidal silver preparations on dogs fed on a particular diet—milk and rice-meat diet—and he thought he was able to lessen regularly and materially the bacterial output which came presumably from the large intestine. His conclusions were favorable to these two preparations. Whether colloidal silver preparations can be given to the human being without producing deposition of silver in the skin is open to question. Therefore, colloidal silver will in all likelihood have to be ruled out from human treatment. What drugs may yet be forthcoming, which are likely to be effective on the intestine, I do not know. I do not think we ought to maintain any strongly pessimistic attitude, however, in regard to future developments.

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THE PHENOL COEFFICIENT OF CERTAIN DISINFECTANTS

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In a recent bulletin from the Hygienic Laboratory, McClintic[1] reports the results of the determination of the phenol coefficient of fifty-four commercial disinfectants. The disinfectants examined were purchased on the open market and their coefficients determined, the method known as the Hygienic Laboratory phenol coefficient being used for that purpose. The disinfectants were, with few exceptions, obtained in the original packages with the labels intact. The preparations were examined and the phenol coefficient of each determined without the addition of organic matter and, in the case of those having a coefficient of not less than 1 without organic matter, the coefficient was also determined in the presence of organic matter. I think it can safely be said that a disinfectant with a phenol coefficient without organic matter of less than 1 is of so low a germicidal efficiency that for practical purposes it may be considered useless, and a waste of time and material to attempt to determine the coefficient in the presence of organic matter.

METHODS FOR DETERMINING PHENOL COEFFICIENT

The method used for the determination of the phenol coefficient, both with and without organic matter, is described in Bulletin 82 of the Hygienic Laboratory; but it may be well to give an abstract of the method.

1. McClintic, Thomas B.: The Determination of the Phenol Coefficient of Some Commercial Disinfectants, Hyg. Lab. Bull. 82, April, 1912.

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A. WITHOUT ORGANIC MATTER

The experiments were done at a temperature of 20 C., maintained by means of a water-bath. The quantity of each dilution of disinfectant and phenol used in each experiment was 5 c.c. The culture used was *Bacillus typhosus*, twenty-four hour extract broth, filtered. The seeding-tubes containing the disinfectant dilutions and the filtered broth culture of *B. typhosus* were placed in the water-bath and allowed to reach the temperature of 20 C. before starting the experiment. The seeding-tubes were inoculated successively every fifteen seconds with 0.1 c.c. of the typhoid culture. Each tube was gently shaken after it was inoculated. At the end of each two and one-half minute period, for fifteen minutes, plants were made from the seeding-tubes into tubes of extract broth. The medium used was standard extract broth having a reaction of + 1.5. The quantity of broth in each tube was approximately 10 c.c.

The tubes were incubated at 37 C. for forty-eight hours, at the end of which time the results were recorded.

To determine the coefficient, the figure representing the degree of dilution of the weakest strength of the disinfectant that kills within two and one-half minutes is divided by the figure representing the degree of dilution of the weakest strength of the phenol control that kills within the same time. The same is done for the weakest strength that kills within fifteen minutes. The mean of the two is the coefficient.

B. WITH ORGANIC MATTER

A stock aqueous solution of organic matter was used containing 10 per cent. peptone and 5 per cent. gelatin. The dilutions of the disinfectant and phenol were made 20 per cent. stronger than the strength it was desired to test in order to allow for the further dilution when the organic matter was added to the disinfectant. The disinfectant dilutions, the organic matter, and the typhoid culture were all placed in the water-bath and allowed to reach the temperature of 20 C. before starting the experiment. To each cubic centimeter of organic matter 0.1 c.c. of typhoid culture was added and thoroughly mixed just before starting the experiment. The quantity of each disinfectant and phenol dilution used was 4 c.c. To each seeding-tube containing 4 c.c. of disinfectant dilution 1.1 c.c. of the mixture of organic matter and typhoid culture were added, the contents of the tube being mixed by gentle shaking. The percentage of organic

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matter in an experiment was 2 per cent. peptone and 1 per cent. gelatin, making a total of 3 per cent. organic matter. The remainder of the technic is as has been described above.

NEED FOR UNIFORMITY IN STANDARDIZATION

No attempt was made to determine the chemical composition of the disinfectants, although a large proportion evidently contained coal-tar derivatives in some form.

Previous to the publication of the Rideal-Walker method in 1903, the standardization of disinfectants may be aptly compared with the standardization of tetanus antitoxin in the United States before the adoption of the American unit in 1907. Prior to that time each manufacturer of tetanus antitoxin had his own method for determining the strength of this important therapeutic agent and there was no possible basis of comparison of the different methods. Since the adoption of the tetanus standard unit by the United States government there has been uniformity in the methods of testing the product.

On account of this lack of uniformity in standardization methods for disinfectants the question has been studied in the Hygienic Laboratory for about two years and the method previously referred to devised. This method has been adopted by some of the branches of the United States government and probably will be by all. Until this method or some other is universally adopted the manufacture and sale of proprietary disinfectants will continue to be in an unsatisfactory condition and their exploitation and sale will be a fertile field for the practice of fraud.

RESULTS OF LABORATORY EXAMINATIONS

The fifty-four commercial disinfectants examined by Dr. McClintic may be divided into four groups, according to their coefficient as determined without organic matter:

1. Those with a coefficient of 3 or better. Of this group there were twelve, or 22 per cent. of the preparations examined.

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2. Those with a coefficient between 2 and 3. There were ten, or 18.5 per cent., in this group.

3. Those with a coefficient between 1 and 2. In this group there were fourteen, or 26 per cent.

4. Those with a coefficient of less than 1 or with an indeterminable coefficient. This group was the largest; in it there were eighteen, or 33.3 per cent. of the fifty-four disinfectants examined.

Thirty-two, or 60 per cent., had a coefficient less than 2 and only three of the 54 had a coefficient of 5 or greater.

When we come to examine the coefficients obtained when determined in the presence of organic matter we find that all are adversely affected by the action of organic matter, and that whereas twelve had a coefficient of 3 or better without organic matter, only three had a coefficient of 3 or better in the presence of organic matter. As more or less organic matter is usually present when disinfectants are used for the destruction of infectious material, it is apparent that the probability is that users of many of these preparations are paying a high price for a weak and sometimes inefficient so-called germicide.

The labels on many of these preparations show grossly exaggerated and sometimes ludicrously absurd claims made by the manufacturers for their particular products.

Some of the labels contained such statements as the following:

In preventing communicable diseases and stopping the spread of contagion, such as small-pox, typhus fever, typhoid fever, scarlet fever, scarlatina, measles, diphtheria, chicken-pox, consumption, cholera, plague, yellow fever, malarial fever, hookworm disease, erysipelas, skin diseases, cancer, pneumonia, influenza, sore eyes, sore throat, mumps, bronchitis, whooping-cough, ——— used systematically, according to directions, insures safety and sharp, definite results, inasmuch as it is many times stronger, bacteriologically, than other preparations, as shown by the carbolic-acid coefficiency stated on label, package and bill.

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Non-corrosive and effective. A disinfectant, germicide, and insecticide, purifier and cleaner. Destroys the germs of disease, protects from contagion and infection of all kinds, destroys parasites, insects, and drives away flies, etc.

Should be used in all cases of sickness, but especially in small-pox, diphtheria, scarlet fever, yellow fever, typhoid, dysentery, etc. More powerful and prompt in its action and more lasting in its effect than all others.

An instantaneous disinfectant and deodorizer. The odorless disinfectant. Reliable, powerful, prompt, cheap. Instantly deodorizes and disinfects any material it is applied to, no matter how fetid or offensive, destroys and neutralizes all gases arising from decayed animal or vegetable matter, arrests decomposition, and prevents contagion. It purifies the air without creating any odor whatever. Dilute highly, according to directions, and sprinkle about freely. It does not stain.

The labels on many of the coal-tar preparations stated that the products were either non-toxic or non-poisonous, whereas tests now being made in the Hygienic Laboratory with the same preparations show them to be toxic for laboratory animals.

It is believed that every disinfectant containing coal-tar derivatives should be required by law to be sold under a poison label, as none of this class is devoid of toxicity.

It is deplorable that only a few disinfectants sold in the United States are prepared under proper scientific control. Many do not even attempt to control their coal-tar ingredients by chemical analysis, as is evidenced by the great variability in the products of the same manufacturer, and very few have attempted to standardize the finished product by bacteriologic tests.

Considering the variability in composition of the coal-tar derivatives used for the manufacture of disinfectants, especially in their phenol content, it can readily be understood that disinfectants prepared from the coal-tar derivatives will vary greatly in germicidal properties. For this reason the different lots of disinfectants made by a manufacturer are liable to give varying phenol coefficients. In fact, quite a variation in the coefficient of

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some disinfectants was found when more than one sample of the same disinfectant were examined. This, of course, is the fault of the manufacturer, and can be remedied only by him.

CONCLUSIONS

Materials of uniform strength and composition should always be used in preparing a disinfectant, and every manufacturer of disinfectants should have his products examined and standardized before they are put on the market. A very few are using the same care and methods in the manufacture of their disinfectants as are used in the manufacture of other drugs; these people are making an honest and most praiseworthy effort to put the manufacture of disinfectants on a scientific basis, and they should be encouraged by the purchase and use of their products instead of the products of those manufacturers who have not yet seen the error of their ways in this respect.

I think every one will agree that the manufacture of disinfectants should be under laboratory control somewhat along the same line as is the manufacture of antitoxins, serums, etc.; and until the manufacture of disinfectants can be controlled or regulated in this manner it will be impossible to say that a disinfectant has a constant phenol coefficient. Every manufacturer of disinfectants should be required to put on the label the phenol coefficient claimed, and when proper examination shows the preparation not to have this coefficient, the manufacturer should be liable to prosecution for misbranding his product.

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INFLUENCE OF SODIUM IODOXYBENZOATE ON REACTIONS OF INFLAMMATORY CHARACTER*

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A rabbit sensitized to horse-serum responds to an injection of a small amount of serum into its epidermis with a loccal reaction at the place of injection. The reaction consists of a swelling accompanied sooner or later with reddening and heat, while frequently more or less pronounced hemorrhages with necrosis occur.

In the course of our investigation it became apparent that the size of these local reactions may be used as a fairly accurate expression of their intensity. We studied the variations in the intensity of these reactions under different conditions. Since the reactions of different animals showed rather wide variations, we followed the extent of the reactions in the same animals for varying periods of time before and after the injection of the drugs to be experimented with.

A number of rabbits received shortly before or after the injections of the serum 10 c.c. of twentieth-normal neutral sodium ortho-iodoxybenzoate solution, intravenously. The effect of the drug on the extent of the reaction is strikingly shown by the accompanying tabulation:

EFFECT OF SODIUM IODOXYBENZOATE ON AREA OF LOCAL REACTION TO SERUM

	2 Hours. mm.	4 Hours. mm.	6 Hours. mm.	24 Hours. mm.
Before administration of sodium iodoxybenzoate..	18.8	22.5	24.6	21.5
After administration of sodium iodoxybenzoate..	5.1	6.6	9.4	9.0

* From the Pediatric and Pharmacologic departments of the Johns Hopkins University.

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A series of experiments in which sodium iodosobenzoate was used in the same concentration and dosage also showed an inhibitory effect on the reactions, but not so striking as that of the sodium iodoxybenzoate.

The administration of sodium iodbenzoate and sodium benzoate in equal molecular concentrations had no inhibitory effect on the local reaction. It was necessary to determine whether the iodoxybenzoic acid exercises an influence on the mechanism of the allergic reaction with which we were dealing.

In another series of experiments, intravenous injections of larger doses of horse-serum were given before the intradermal injections. This also reduces the local reactions very markedly. In this case we have to do with an anti-anaphylactic phenomenon.

It is known that the fall in blood-pressure on reinjection of sensitized dogs can be prevented by the slow injection of small amounts of horse-serum; but a previous injection of sodium iodoxybenzoate in dogs sensitized to horse-serum does not prevent the usual large drop in blood-pressure on the injection of a second dose of horse-serum. It is therefore evident that the mechanism by which the sodium iodoxybenzoate influences the cutaneous reaction cannot be attributed to an influence on the general allergic reaction.

In another series of experiments we studied the local effect of sodium iodoxybenzoate in the following manner:

The animals (rabbits) received in the right side of the abdomen a certain amount of serum diluted with saline solution, in the other side the same amount of serum diluted with a sodium iodoxybenzoate solution; in a third situation a solution of iodoxybenzoate alone was injected as a second control.

The results were plotted in a chart, which is not reproduced here,[1] but which showed that here also the sodium

1. Amberg and Knox: Jour. Pharmacol. and Exper. Therap., 1912, iii, 223.

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iodoxybenzoate exercises an inhibitory influence particularly during the first four hours.

From the studies of Loevenhart[2] it appeared probable that the iodoxybenzoate and iodosobenzoate may affect oxidation processes in the organism. Therefore we thought it possible that the influence of these drugs used in our experiments is attributable to their effect on oxidation processes, a point of view supported by the inactivity of the iodbenzoic acid.

A further ground for this hypothesis was furnished by the results attained in a series of experiments with sodium cyanid, a drug which is known to interfere with the oxidative processes of the tissues. In the latter experiments the rabbits received intradermally in the side of the abdomen a certain amount of serum diluted with a solution of sodium cyanid, and in the other side the same amount of serum diluted with a solution of sodium hydroxid, the alkalinity of which corresponded to that of the sodium cyanid solution. A third injection was given at another point with the same solution of sodium hydroxid alone. The results showed that particularly during the first few hours the reactions obtained with the serum-sodium cyanid are more intense than those with the serum-sodium hydroxid.

From our studies we incline to the view that the sodium iodoxybenzoate does not affect the general allergic reaction but that it does influence the local intracutaneous reaction which owes its origin to the production of some toxin resulting from the reunion of allergin and ergin.

The intracutaneous reaction is of an inflammatory type. The influence of the iodoxybenzoate noted seems to inhibit particularly the degree of swelling. This local swelling is chiefly characterized by serous infiltration, that is, by edema. Therefore we may, perhaps, express our results as follows:

2. Loevenhart and Grove: Jour. Pharmacol. and Exper. Therap., 1909-1910, 281; ibid., November, 1911.

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Sodium iodoxybenzoate inhibits a certain phase of an inflammatory reaction, while sodium cyanid intensifies it.

Since the influence of these drugs possibly may be attributable to their effect on oxidation processes in the tissues our results seem to confirm the contention of Martin Fischer[3] that any interference with the oxidative processes of the tissues is likely to favor the production of edema.

Edema we consider one of the manifestations of inflammation, and we suggest the hypothesis that any measures, favoring the oxidative processes have a tendency to inhibit certain phases of inflammatory phenomena, while measures interfering with oxidative processes have the opposite tendency.

We recall here the results obtained by Loevenhart[4] in the treatment of certain skin infections by an ointment of benzoyl peroxid. This author thought that the healing effect of the ointment was due partly to the antiseptic property of this drug and partly to its influence on the tissue-cells favoring oxidations. The beneficial result of the open-air treatment of tuberculosis, of infective conditions in general and even of open wounds may possibly be explained in part on the same hypothesis.

So far our experiments were conducted with a peculiar form of reaction, but our recent experiments with mustard-seed oil have shown that here also iodoxybenzoate and iodosobenzoate have a striking inhibitory effect on the local intracutaneous reaction, while iodbenzoic acid has none.

Of special interest are results with the intracutaneous administration of diphtheria toxin. Twenty-four hours after the injection rabbits treated with iodoxybenzoate showed a marked inhibition of their reactions, while subsequently the reactions of treated and untreated animals took about the same course. This result is the more remarkable as the reactions of the untreated ani-

3. Fischer, Martin H.: Oedema, 1910.
4. Loevenhart: Therap. Monatsh., 1905, xix, 426.

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mals do not develop visibly before about twelve hours after injection of the toxin; that is, at a period when the immediate effects of the iodoxybenzoate are not likely to exist any longer.

The conception is therefore suggested that the injection of the iodoxybenzoate produced such changes in the organism as to alter its local reactivity to diphtheria toxin.

It appears to us not impossible that the altered reactivity in this case is primarily due to some influence on the oxidative processes of the organism.

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EFFECT OF IODIDS ON THE CIRCULATION AND BLOOD-VESSELS IN ARTERIOSCLEROSIS

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The iodids have long enjoyed the reputation of exerting a beneficial influence on arteriosclerosis. Their extensive use in this condition has been largely brought about by the enthusiastic teaching of the French school. Huchard[1] ascribed to iodids the power "to lower arterial tension, to render more active the nutrition of organs, to effect resolution of degenerative processes in the vessel-walls and to lower peripheral resistance." A belief in their power to improve the mechanical factors of the circulation and to act favorably on the vessel-walls forms the basis of our modern iodid therapy in arteriosclerosis. It will be profitable to weigh the evidence on which this belief rests.

I. EFFECT ON BLOOD-PRESSURE

Potain[2] was one of the first to attribute the virtue of iodid to a lowering of blood-pressure, which he considered was brought about by its action on the heart and vasomotor nerves. Animal experiments to determine this point have given somewhat conflicting results. Sée and Lapicque[3] gave intravenous injections of potassium iodid and noted first a rise then a fall of blood-pressure, which they attributed to heart weakness.

1. Huchard: Traité de thérap. appliquée, Paris, 1897, i, 295.
2. Potain: La clinique médicale de la Charité, Paris, 1894.
3. Sée and Lapicque: Bull. de l'Acad. de méd., 1889, xxii, 823.

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Huchard and Eloy[4] obtained a marked fall in blood-pressure following the administration of potassium iodid to rabbits, but only after large doses. A very careful series of experiments on animals was carried out by Prevost and Binet[5] by means of injections of both iodin and iodid salts. They failed to obtain any effect on arterial pressure from moderate doses, while excessive doses produced a fatal fall.

Isaak and Vander Velden[6] observed that following the injection into cats of iodid-egg albumin there was slowing of the pulse and a fall in the pressure, as a result of vagus stimulation, whereas after sodium iodid and potassium iodid no such effects were produced. Barbera[7] reported a similar effect on pulse and pressure from the injection of large doses of sodium iodid in animals, but attributed the result to a paralysis of the depressor nerves of the heart. In rabbits neither organic nor inorganic compounds caused any variation in the pressure. Likewise, in frogs, Kraus[8] detected no influence of various iodid preparations on the arterial tension.

The most exhaustive and convincing experiments of Gumprecht[9] led him to conclude that in the rabbit small and large doses of iodids were without influence on the pressure; that only extremely large doses endangering life caused a fall in tension; that neither a local dilating action on the vessel-wall nor a paralysis of the vasomotor center could be demonstrated.

The clinical evidence is not of a positive character. In reviewing the literature one is struck with a surprising difference of opinions on the part of clinicians as to the

4. Huchard and Eloy: Bull. gén. de thérap., August, 1892.
5. Prevost and Binet: Action de l'Iode et des Iodures sur la pression arterielle, Rev. med. de la Suisse, 1890, No. 8.
6. Isaak and Vander Velden: Untersuchungen über das Verhalten des Kreislaufs bei Zuführ jodierter Eiweiss-Körper, Med. Naturweiss, 1907, Arch. 1, 105.
7. Barbera: Ueber die Erregbarkeit von Herz und Gefässnerven nach Injectionen von Iod. Arch. f. d. ges. Physiol., 1897, lxviii, 434.
8. Kraus: Die Pathologie des Schilddrüse, Verhandl. d. Kong. f. inn. Med., 1906, p. 38.
9. Gumprecht: Die Bedeutung des Iods als Vasomotorenmittel, Verhandl. d. Kong. f. inn. Med., 1901, xix, 260.

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influence of the iodids on arterial tension. The problem has not received the careful study that its importance deserves. It must be admitted, however, that the effect of any slowly acting drug on the pulse is not easy to determine because so many other therapeutic measures, such as cathartics, baths, diet, etc., are usually employed during the iodid treatment.

Asher[10] considers that iodids lower the blood-pressure by acting on the vagus and the depressor nerve of the heart.

Chelmonski[11] advocates iodids to check internal hemorrhage, so sanguine is he that they lower arterial tension. Lewy[12] has seen no vasomotor action of iodids in health, but in disease of the arteries and heart he maintains that it acquires this property. This idea is strengthened by the observations of Thaussig,[13] who produced, by daily doses of iodipin in chronic lead-poisoning with hypertension, falls of 80 to 110 mm. Hg in the course of one to three weeks. A similar fall in a case of lead-poisoning was obtained by Pal[14] (165 to 75 mm.) by administering potassium iodid in doses of 5 gm. per diem for only a few days.

On the other hand, there is excellent authority for believing that iodids do not in therapeutic doses exert any influence on the size of the arterial lumen or on the heart's action (Romberg,[15] Harnack,[16] Cushny,[17] J. Mackenzie[18]).

Gumprecht's clinical studies are in accord with those he made in animals, viz., that single doses of iodids do not alter blood-pressure and that the long-continued use

10. Asher: Discussion, Verhandl. d. Kong. f. inn. Med., 1901, xix, 283.
11. Chelmonski: Iodnatrium und Iodkalium als Heilmittel bei Blutungen, Arch. f. klin. Med., 1899, lxiii, No. 5, p. 636.
12. Lewy: Discussion, Verhandl. d. Kong. f. inn. Med., 1901, xix, 283.
13. Thaussig: Zur Kenntniss der Gefässwirkung des Iods, Wien med. Wchnschr., 1902, lii, 1399.
14. Pal: Quoted by Janeway (see Footnote 23).
15. Romberg, E.: Ebstein-Schwalbe Handbuch der praktischen Medizin, 1905, iv, 721.
16. Harnack: Centralbl. f. Physiol., 1898, p. 291.
17. Cushny: Pharmacology and Therapeutics, Phila., 1906, p. 570.
18. Mackenzie, J.: Diseases of the Heart, Oxford, 1908, p. 266.

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of iodids has no constant and distinct influence on pressure either in healthy individuals or in the subjects of arteriosclerosis. In a number of cases of arteriosclerosis with hypertension, I have given a single daily dose of potassium iodid for several days. I have been unable to obtain either an immediate or a remote effect on the blood-pressure.

A decrease in the viscosity of the blood was suggested by Müller and Inada[19] as the chief action of the iodids, with a secondary influence on the pressure. Boveri[20] noted a lessened viscosity of the blood both in rabbits and in men, especially those with hypertension, whereas Bachmann[21] obtained no positive results in his experimental work. The most authoritative conclusions come from Determann,[22] who found sometimes an increase, at other times a decrease in the viscosity. He considers these variations are all within the limits of the physiologic variation of viscosity.

It may be properly deduced from these investigations that *the iodids in therapeutic doses are not vasodilators in their immediate action as are the nitrites* (Janeway[23]). In the hypertension of arteriosclerosis (with the possible exception of cases of lead-poisoning) it has not been proved that the continuous administration of iodids lowers blood-pressure. It is improbable that the viscosity of the blood is sufficiently decreased by iodids to alter blood-pressure materially.

II. EFFECT ON BLOOD-VESSELS

When Koranyi[24] announced that by injecting iodipin simultaneously with epinephrin into animals he could

19. Müller and Inada: Zur Kenntniss der Iodwirkung bei Arteriosclerose, Deutsch. med. Wchnschr., 1904, xxx, 1751.
20. Boveri, P.: Viscosité du sang et iode, Presse méd., Aug. 3, 1908.
21. Bachmann, E.: Weitere klin. Beiträge zur Viskositäts-Bestimmung, Med. Klinik, 1910, No. 35.
22. Determann: Das Verhalten der Blutviskosität bei Ioddarreichung, Deutsch. med. Wchnschr., 1908, No. 20.
23. Janeway, T.: Clinical Study of Blood-Pressure, New York, 1904, p. 239.
24. Koranyi: Ueber die Wirkung des Iods auf die durch Adrenalin erzeugte Arterionekrose, Deutsch. med. Wchnschr., 1906, xxxii, 679.

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prevent the atheromatous effects of epinephrin on the arteries, the explanation of the action of iodid on arteriosclerosis seemed close at hand. He believed that the iodid counteracted the effect of the increased blood pressure excited by epinephrin and thus protected the arterial wall from degenerative changes. Unfortunately his results were not confirmed by later investigation. Biland[25] and also Loeb and Fleisher,[26] in a large number of well-controlled experiments, found that iodin preparations instead of preventing, actually aggravated the arterial necrosis of epinephrin.

It is by no means necessary, however, to abandon our belief in the efficacy of iodid in arteriosclerosis because there is inadequate proof of its action on the pressure. Absorption of the cellular infiltration in the vessel-walls would improve the circulation by enlarging their lumen and restoring in some degree the vascular tonus. That iodids are of benefit in syphilitic endarteritis is generally agreed. According to Osler,[27] there is no other drug that has a direct influence on the coats of the vessels. Whether they bring any structural change in other forms of arteriosclerosis is open to question.

THEORIES OF ABSORPTIVE ACTION

Various theories have been advanced to explain the beneficial effects of the iodids on absorption, more especially in syphilis. The most important are as follows:

A. That iodids are germicidal. This is untenable because the spirochetes are not destroyed by the drug and syphilis cannot be cured by iodids alone.

B. That opsonins are increased by iodids. Van Strübell[28] found the opsonic index was decreased for staphylococci. So far as I am aware, the opsonins in

25. Biland, J.: Deutsch. Arch. f. klin. Med., 1906, lxxxvii, 413.
26. Loeb, L., and Fleisher, M. S.: Influence of Iodin Preparations on the Vascular Lesions Produced by Adrenalin, Am. Jour. Med. Sc., 1907, cxxxiii, 903.
27. Osler, W.: Modern Medicine, Phila., 1908, vi, 445.
28. Van Strübell: Die Wirkung des Iods auf den menschlichen und tierischen Organismus, Berl. klin. Wchnschr., 1911, No. 50.

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syphilis have not been studied in relation to iodid treatment.

C. That leukocytosis and an increased flow of lymph is induced by iodids (Heinz[29]). Both of these reactions are slight, and, as they also occur from chlorids, cannot be looked on as in any way specific for iodids.

D. That free iodin is liberated in the gumma and in some way promotes absorption (Binz[30]). According to Heinz, the iodin is set free by the leukocytes and as a result of increased metabolism the gumma is absorbed.

E. That iodids increase the permeability of the vessel-walls (Heinz) and thereby promote absorption. This theory is largely hypothetic.

F. That iodids produce a *proteolytic ferment* (Dick[31]). This is best illustrated in the febrile reaction produced by iodids in certain diseases.

THEORY OF PROTEOLYSIS

In 1889, Marchoux and Bourret[32] pointed out that potassium iodid caused a febrile reaction in leprosy, similar to the reaction following the injection of tuberculin in tuberculosis. It is known that potassium iodid may set up a thermal reaction in tuberculosis (Sorel[33]). I have recently seen an exacerbation of fever and pulse in a case of actinomycosis in Dr. Halstead's clinic following large doses of potassium iodid. Furthermore, it exerts a distinct absorptive action on the granulomas of actinomycosis and leprosy as well as of syphilis (Ricketts[34]).

The explanation has been given that the potassium iodid in some way attacks the causative bacteria and sets free the specific toxins.

29. Heinz: Ueber Iod und Iod-Verbindungen, Virchow's Arch., 1899, clv, 44.
30. Binz: Die Zerlegung des Iodkaliums in Organismus, Virchow's Arch., 1875, lxii, 124; also Arch. f. exper. Path. u. Pharmakol., 1894, xxxiv, 185.
31. Dick, George F.: Personal communication.
32. Marchoux and Bourret: Quoted by Sorel (see Footnote 33).
33. Sorel, F.: Iodure de potassium et tuberculine, Ann. de l'Inst. Pasteur, 1909, xxii, No. 7, p. 533.
34. Ricketts, H.: Infection and Immunity, A. M. A. Press, Chicago, 1906, p. 434.

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Sorel investigated this theory in tuberculous guinea-pigs, which he found were very susceptible to the action of potassium iodid. Tuberculous pigs immunized against potassium iodid were still susceptible to the tuberculin reaction and conversely, after immunization against tuberculin, they gave a febrile reaction to potassium iodid. He proved that peritoneal exudate induced in the tuberculous animal by injecting potassium iodid into the cavity contained no tuberculin. From these premises, he concludes that potassium iodid does not split up the bacterial proteid as tuberculin does, and its action is not truly specific. The reaction may be represented as follows:

The union of potassium iodid with antibodies already present in the infected individual gives rise to a ferment which has the power of digesting certain proteids (granulomatous cells, gumma, etc.). In this process, toxic substances are formed which create local inflammation in the lesion and at times a general febrile reaction.

If this hypothesis is correct, we can see how potassium iodid may have the power of setting up a proteolytic ferment which has a *selective* (not specific) action on the diseased granulomatous tissue of the arteries in a certain group of diseases. The digestion and absorption of cellular accumulations are most complete in syphilis, less so in actinomycosis, leprosy and tuberculosis. This conception makes it clear why iodids so remarkably cure one manifestation of syphilis, viz., the round-cell infiltration and yet do not destroy the spirochete or terminate the disease as a whole.

CONCLUSIONS

Iodids in therapeutic doses are not active vasodilators and when long continued do not materially affect blood-pressure.

Iodids do not alter the viscosity of the blood to any marked degree.

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The iodids probably owe their beneficial influence in syphilitic acteriosclerosis to the absorption of the cellular exudate in the arteries. The absorption may be brought about by the formation of a proteolytic ferment which is created by the union of iodid with antibody, and which has a selective action on the luetic cellular exudate. It is possible that this selective digestive action may be operative to a lesser degree on the cellular exudate in arteriosclerosis due to other causes than syphilis.

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ABSTRACT OF DISCUSSION

DR. BERNARD FANTUS, Chicago: Clinicians have pretty definite ideas as to the effect of iodids on pathologic tissue—ideas which they have obtained by the study of countless cases and which are almost as reliable as those obtained from experiments on animals. I believe that it can be demonstrated that iodids are capable of diminishing the size of tuberculous lymph-nodes and that it can be proved that certain goiters diminish in size under iodid treatment. Thus, I have records of about a dozen cases of goiter which in six months of iodid treatment have been reduced in size by about three-quarters of an inch to an inch and a half. It seems that the mode of action must in all these cases be similar to that responsible for the benefit obtained in syphilis, and the theory that has been endorsed by Dr. Capps, which seems to me the best theory that we have yet had advanced, would also have to be applied to these other conditions, except that perhaps in case of goiter we would have to think of cellular rather than of bacterial antibodies.

DR. J. A. CAPPS, Chicago: The reference of Dr. Fantus to the therapeutic use of iodids in tuberculosis suggests an interesting point. Pathologists frequently express the opinion that the administration of iodid is sometimes responsible for the development of miliary tuberculosis; that in advanced pulmonary tuberculosis particularly the administration of large doses of iodid causes a breaking down of tubercles and allows bacilli that were partly walled off to be absorbed in the blood and in this way induces a general dissemination of bacilli throughout the body. We need more evidence on this question. This is one of the problems which deserves further attention and which seems amenable to experimental work to determine whether the tuberculous foci are broken down by the administration of large doses of iodid.

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DUODENAL MEDICATION OF IPECAC IN THE TREATMENT OF AMEBIC DYSENTERY

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In East India and other oriental countries, ipecac has been regarded for a century or more as the great remedy for dysentery. In Europe and America, treatment by ipecac had fallen into disuse until quite recent times, on account, first, of its emetic action, second, of the deterioration and adulteration of the drug, and third, of improper methods of administration. The revival within the past decade of the use of this drug as a remedy for dysentery was largely due to Patrick Manson, whose extensive experience in the tropics thoroughly convinced him that it was an efficient remedy.

Besides Manson, a number of other authorities attest the value of ipecac. Notably among these are Woodhull, Major Rhoades, Simon, Dock, Freund, Barker and others. Woodhull[1] refers to it as the one remedy which, if properly used, is as conspicuous in dysentery as quinin is in the malarial fevers, and urges medical officers to use large doses of it in all types of amebic dysentery. He further adds that he has not known the treatment to fail. Major Rhoades, U. S. Army, regards ipecacuanha and quinin as the sovereign remedies, the former by the mouth, the later by the rectum, and maintains that, if properly administered, the drug will give brilliant results in the majority of cases. If properly administered, it is considered by S. K. Simon almost a specific for amebic dysentery. He asserts that the amebas vanish almost at once.

1. Woodhull: Therap. Gaz., April 5, 1902.

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It may be interesting to note that our present attitude toward the ipecac treatment of dysentery is very much the same as it was 150 years ago. The following quotation from the United States Dispensatory, 1854, will serve to illustrate.

> John Helvetius, grandfather of the celebrated author of that name, having been associated with a merchant who had imported a large quantity of ipecacuanha, employed it as a secret remedy, and with so much success in dysentery and other bowel affections that general attention was attracted to it, and the fortunate physician received from Louis XIV a large sum of money and public honors, on the sole condition that he should make the remedy public.

Sixty-five years ago the statement was made, in Watson's "Practice of Physic," that "subsequent to bleeding, the remedy from which the greatest benefit is derived is ipecacuanha." It has been repeatedly alleged that ipecac in small doses is a good prophylactic against liver abscess. Indeed Calvert, professor of materia medica in the Calcutta Medical School, goes so far as to state that he believes ipecacuanha will cure hepatitis following dysentery, provided there is no suppuration. In this connection it is interesting to note a statement made by Pilgrim,[2] superintendent of the Calcutta General Hospital.

> In the past four years over 200 cases of dysentery have been treated and eighty-two cases of hepatitis. During the past three years since ipecac has been systematically employed not a single case of dysentery has been complicated by hepatitis, while every case of hepatitis has recovered without suppurating. The average number of operations for liver abscess has fallen from ten or twelve to three or four in the year.

There is a diversity of opinion as to the proper method of administration, and yet, according to the experience of all who have employed ipecac, the proper method is insisted on. Buchanan's[3] experience in Bengal has been very favorable in those cases in which he employed large

2. Pilgrim: Brit. Med. Jour., 1910, ii, 2039.
3. Buchanan: Practitioner, December, 1897.

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doses. Small doses, from 3 to 5 grains in pills, are utterly useless. His directions are as follows:[4]

Castor oil should be given the night before, and, after the bowels have moved in the early morning, tincture of opium, followed in fifteen or twenty minutes by ipecacuanha in a dose of 25 or 30 grains. The patient should lie undisturbed for four or five hours. If vomiting occurs or if the stool has not much changed for the better within twenty-four hours, ipecacuanha is to be repeated in half an hour.

Woodhull employs a somewhat similar method, but uses counter-irritants over the epigastrium, such as iodin or mustard. He says:

The stomach must be empty and the patient recumbent. About twenty minutes before giving the ipecac, it would be well to paint the epigastrium with tincture of iodin, or apply a mild sinapism, though this may be omitted. Ten or fifteen minims of tincture of opium may be given to be followed in ten or twelve minutes by 15 to 30 grains of ipecac. Nothing should be given by the stomach for at least four hours and the recumbent posture should be strictly maintained. If the first dose is rejected, it should be repeated after a short interval. Ipecac controls capillary hemorrhage and before confirmed inflammation sets in, capillary leakage is the feature of dysentery; hence its favorable effects in this disease.

Major Rhoades' method of treatment is as follows:[5]

The patient, having received his preliminary purge and all food and water having been proscribed for six hours, is given a hypodermic injection of morphin sulphate, ¼ grain (0.016 gm.) to prevent vomiting. At the same time an ice-bag filled with finely cracked ice and protected with two thicknesses of gauze is placed over the pit of the stomach and another over the anterior surface of the neck. The patient is directed to lie flat on his back, a third ice-bag being substituted for a pillow and placed under the nape of the neck. The patient is cautioned not to speak or move for four hours. One-half hour after the morphin injection, the ipecacuanha is administered in eight to twelve pills of 5 grains each. The patient is encouraged to resist by mental effort the desire to vomit and to try to sleep. When the saliva begins to flow freely, he should be cautioned not to swallow it. Unless this is done,

4. Sajous' Annual, iii, 45.
5. Modern Treatment, p. 149.

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vomiting will almost certainly occur. If vomiting does occur within an hour after administering the dose, it should be repeated when the stomach has become quieted. After six hours a small glassful of iced ginger ale or a cup of tea is given, followed by frequent feedings of beef-tea and albumin-water late into the night. The following morning, the dose of ipecacuanha is repeated and again on succeeding days until copious, pultaceous, brownish-yellow stools appear and rapid amelioration of acute symptoms give evidence that healing had set in. This being the case, the dosage of the ipecacuanha is reduced to a 5-grain pill or capsule three times daily, and continued for about a week longer; the diet is increased, and at the same time lavage of the colon is begun.

Patrick Manson[6] has still another means of administration:

The patient must abstain from food and drink for at least three hours. Twenty drops of laudanum are then given, and a mustard poultice applied to the epigastrium. About twenty minutes later, 20 to 30 grains of powdered ipecacuanha root, either in bolus or in a small quantity of water, are administered. The patient must then lie flat on his back without a pillow, and endeavor to avoid vomiting; he may neither eat, drink, speak nor move for three or four hours. If vomiting occur soon after the powder is given, in an hour or two a second dose may be administered. After three or four hours, small quantities of food may be given during the succeeding six or eight hours, when the drug is to be repeated. Guided by its effects, the use of ipecacuanha is kept up for two or three days. A great drawback to this treatment is the severe vomiting which sometimes ensues; but, notwithstanding this drawback, there can be no question of its value in some cases, although in others it appears to do little or no good. If the ipecacuanha produce a large loose, bright yellow stool, improvement is nearly sure to follow.

The action of ipecac on the ameba has not been definitely determined. Vedder, U. S. Army, made some bacteriologic experiments[7] and showed that the *Bacillus dysenteriæ* was inhibited by a 2 per cent. fluid extract of ipecac. While the amebas in a 5 per cent. bouillon culture were at all times killed by a fluid extract of

6. Manson: In Gibson's Practice of Medicine, 1901.
7. Vedder: Bull. Manila Med. Soc., March, 1911.

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ipecac in a dilution of 1/50,000, sometimes they were killed by a higher dilution of 1/200,000. Two varieties of amebas were used, but not *Entamœba coli* or *Entamœba dysenteriæ*. He insists that ipecac should be used containing the proper amount of emetin, and condemns its use in cases of the bacillary form of dysentery. Dr. H. A. Freund made some experiments with ipecac on the live amebas from the stools in the warm stage. He concluded that it had a direct destructive action on the amebas and besides this effect it acts apparently as a cholagogue and sometimes as a purgative. Under the treatment, the ameboid motion of the parasites ceases in a few hours and disappears completely in two or three days.

From this cursory review of the literature one is forcibly impressed with the fact that ipecac has a definite action on the amebas, and, if properly administered, is undoubtedly the best remedy at our command. What is generally conceded, however, to be the proper method of administration proves such a formidable procedure that the treatment is wholly impracticable.

In an attempt to overcome the many objectionable features of the methods in vogue, a simple, rational and more practical method has suggested itself to me, in the use of the Einhorn duodenal tube. This tube was designed for duodenal aspiration and alimentation and it will be found an ideal instrument for the treatment of dysentery with ipecac. For a complete description of the duodenal tube and the method of its introduction, the reader is referred to the original article by Max Einhorn.[8] As a rule patients have little difficulty in swallowing the tube and comparatively little discomfort afterward. An examination of the stomach contents, to determine the presence of free hydrochloric acid, will help determine whether the tube has passed through the pylorus, which is done by aspirating a little of the fluid and testing with congo paper. After each aspiration the

8. Einhorn, Max: Med. Rec., Jan. 15, 1910.

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tube is washed out with a little water and clamped. When it has entered the duodenum, the aspiration is slower and more difficult and the fluid is alkaline and bile-stained. Einhorn also recommends a milk test. The patient is given a few swallows of milk and the stomach is then aspirated. If milk is absent, the capsule is in the duodenum. The time required for the capsule to pass into the duodenum varies from one to five or more hours.

Ipecac is especially indicated in acute cases and in the exacerbations of the chronic forms. It is said by some clinicians to have practically no effect in cases in which the symptoms are due to a mixed infection.

In spite of the fact that all my cases were extremely chronic and refractory, three of them being complicated with liver abscesses, the results were fairly striking, but the cases are reported more for the purpose of emphasizing the method than the results of treatment. Powdered ipecac was employed either suspended in mucilage of acacia or macerated in plain warm water. A 2-ounce metallic syringe was used to instil the remedy which represented from 1 to 2 drams of ipecac to the dose in a 6-ounce mixture. Unquestionably much of the success of treatment depended on the quality of the drug. Those cases which required more than three or four doses and in which the amebas reappeared in the stools were treated by a drug of an inferior quality. On the other hand, the cases treated with a physiologically tested powder yielded after the first or second dose.

CASE REPORTS

CASE 1.—*Patient.*—J. S., male, aged 64, janitor, ten years ago suffered from a liver abscess attributed to a wagon running over his abdomen. He recovered from the operation, but never enjoyed good health. Before the accident he suffered from mild attacks of dysentery and a few years after had an acute attack with bloody mucus in the stools and much tenesmus lasting several months. No history could be obtained of the discovery of amebas in the stools or liver abscess.

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Examination.—The patient showed marked pallor and emaciation and suffered from a moderately advanced pulmonary tuberculosis. The abdomen was somewhat distended and coursed with large superficial veins. There was an area of considerable resistance over the upper right rectus and tenderness along the border of the eighth and ninth ribs on the right side. Owing to this tenderness, the liver could not be palpated. He had a leukocytosis of 21,000. For several months he had a number of dysenteric stools each day which contained pus, blood and mucus. A large number of active *Amœbæ coli* and yeast-cells were found on examination of the stools.

Treatment and Course.—Patient was admitted to the Mercy Hospital, Dec. 12, 1910, was ordered a semisolid diet and salines followed by the administration of ipecac. After the introduction of the tube the first dose (1½ drams) suspended in mucilage of acacia was administered. No other discomfort than slight nausea ensued. Examination the next day showed amebas in the stool, but these disappeared after an ipecac enema (3iv—Oi). Several days later, the ipecac enema was repeated with the results negative for amebas. Two weeks later ½ dram of ipecac was administered duodenally followed by vomiting without expelling ipecac. The following day a dram was administered, the results remaining negative for amebas. The stools were examined at intervals of one or two weeks after the patient left the hospital and no amebas were found for six months, when a few, slightly motile, appeared in the stools which averaged from two or three semisolid ones a day. A month later, when amebas were again found, 1½ drams of ipecac was administered duodenally in my office. No vomiting occurred. The next day the patient had six or eight diarrheic stools; since then the stools have been better formed; there has been less abdominal tenderness and no amebas. The patient was readmitted into the hospital in December, 1911, with alcoholic pneumonia, from which he died. Previous to this illness, the stools were formed and free from amebas. The pneumonia was associated with severe diarrhea, but careful examination of the stools failed to find amebas.

Case 2.—*Patient.*—G. S. F., male, aged 32, soldier (referred by Dr. F. J. Snyder, York, Pa.), was admitted to Mercy Hospital, March 28, 1911. He contracted amebic dysentery while serving as a soldier in the Philippine Islands. The disease began as a simple diarrhea, the number of stools varying from six to twelve daily. After three months, the stools

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were mixed with blood and pus and associated with great tenesmus. At this time he was treated with ipecac and quinin according to the method of Major Rhoades. In spite of the ice-bag applied to the back of the head and the spine, the mustard plaster to the epigastrium, the opiate internally and enforced quietude for hours before and after the administration of ipecac, the patient vomited after each dose. Some improvement was noted after the treatment, but the symptoms soon returned.

Examination.—From this time until 1907 he had been able to do light work, but since then became totally incapacitated. On admission to the hospital he presented an emaciated and anemic appearance with dull expression and sunken eyes. The cervical and inguinal glands were slightly enlarged. The abdomen was somewhat flattened and retracted, the recti muscles were tense and rigid and there was a marked tenderness over the whole abdomen. There was no apparent enlargement of the liver or spleen. The patient had a leukocytosis of 12,500. The stools averaged eight to ten daily, watery or semisolid in character, and contained mucus, pus and blood. Active amebas were found in large numbers, as many as ten and twelve to the field.

Treatment and Course.—Patient was put to bed and on liquid diet. Several high saline enemas were given. Stomach contents showed free hydrochloric acid. March 31, the duodenal tube was introduced at noon; a glass of milk and slice of bread were given at the same time.

At 4:30 p. m. aspirated fluid was alkaline and bile-tinged; then 1½ drams of ipecac in water were administered. Slight nausea followed but no vomiting. At 6:30 p. m. a second dose of 1½ drams was given which caused some nausea and vomiting of mucus but no ipecac.

Two days later the stools were well formed, passed without tenesmus and were free from blood and amebas. A high enema consisting of ½ ounce of powdered ipecac with 10 minims of laudanum in a pint of water was given and retained for fifteen minutes. This was repeated the next day. On April 4, the fifth day of treatment, 1½ drams of ipecac were administered duodenally and retained. This was followed next day by another ipecac enema, which completed the treatment.

The amebas disappeared from the stools after the first duodenal medication and colonic irrigation with ipecac. The patient was in the hospital ten days. A period of fourteen months has elapsed without treatment during which he has averaged one well-formed stool each day, has gained in weight

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and strength and worked steadily. Repeated examinations of stools have been negative for amebas.

CASE 3.—*Patient.*—W. K., male, aged 35, soldier, (treated through courtesy of Dr. Craighill) was admitted to the University Hospital April 25, 1911. Patient had contracted amebic dysentery in 1907, while serving in the Philippines. Symptoms were very acute from the beginning, averaging from thirty to forty stools a day, each containing blood and mucus. He lost about 50 pounds during the first month of illness. For the first two years following the attack he averaged from fifteen to twenty stools a day and more recently from seven to eight. Early in the attack, yellowish-brown pigmentation of the skin developed. There was no nausea or vomiting but much pain and soreness in the abdomen. Shortly before admission to the hospital he developed a cough and night-sweats.

Examination.—The patient was extremely septic. He was emaciated, cachectic and slightly jaundiced, with puffiness under the eyes. The liver was enlarged and painful on pressure but there was no fluctuation. The stools were thin, watery, yellow in color and contained mucus, blood and *Amœbæ coli.* Numerous leukocyte-counts showed a fluctuating leukocytosis from 8,000 to 11,200. The hemoglobin was 40 per cent. Gastric analysis revealed the presence of hydrochloric acid with a total acidity of 26.

Treatment and Course.—April 30, 1911, at 8:30 a. m., the patient swallowed the duodenal tube without difficulty. At 11:30 a. m. a dram of ipecac was administered. The tube was left *in situ,* but the patient vomited some mucus containing a little ipecac about half an hour later, which caused the tube to be partly expelled. One-fourth grain of morphin was given hypodermically and at 4:30 p. m. a second dram of ipecac was given. This was also followed by vomiting of mucus and a little ipecac. A slight depression followed as an effect of the drug. The following day an enema containing 2 drams of ipecac with 20 minims of laudanum in a pint of water was given. This was repeated the next day, and the following day at 3:30 p. m. a dram of ipecac was administered duodenally followed in a few hours by another dram, which caused nausea and vomiting. Another ipecac enema was given the next day when, owing to the condition of the patient, it was considered inadvisable to continue treatment.

CASE 4.—*Patient.*—G. L., male, aged 62, soldier, contracted dysentery while serving in the army at Fortress Monroe, in

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1888. The disease persisted with great severity until 1893, after which the symptoms abated and the disease ran a milder course until 1901. During this year two liver abscesses developed, both of which were relieved by operation. The following year an acute exacerbation occurred which was temporarily relieved by quinin irrigation. Since then he had suffered more or less continuously until his admission to the hospital Sept. 6, 1911.

Examination.—The patient was sallow, cachectic and much emaciated. He had marked abdominal tenderness but no enlargement of the liver. He averaged twelve loose movements a day. The stools were either liquid of semisolid, composed largely of pus, blood and mucus with numerous motile *Amœbæ coli.*

Treatment and Course.—Two days after his admission, 2 drams of ipecac were administered through the duodenal tube in doses of 1 dram each, one hour apart. No noticeable effects resulted from the first dose but after the second the patient complained of nausea which was followed in an hour by a chill and vomiting of mucus. Two days later and after the third dose of ipecac the stools were examined, but no amebas were found. The third and fourth doses were followed by some discomfort and, in one instance, a small quantity of clear fluid was vomited but no ipecac. After the fourth administration a saline and an ipecac enema was given. The stools remained watery but free from amebas and gradually decreased in number. After the sixth administration of ipecac the treatment was discontinued. The dysenteric symptoms persisted for several weeks without the appearance of amebas in the stools. The stools then became well formed and have averaged one per day up to the time of his last report, eight months after treatment. During this time no amebas have appeared in the stools and his health, twenty-four years after contracting the disease, has been restored.

CASE 5.—*Patient.*—F. C. H., female, aged 34, (referred by Dr. Buxton) had good health until 1906, when dysentery set in, which persisted for five years. During this time she averaged from ten to twelve dysenteric stools daily, usually accompanied with tenesmus. Then followed a period of eight months during which she enjoyed fairly good health and averaged one well-formed stool per day. Four months before admission to Mercy Hospital the dysentery returned, averaging four to five stools daily, each containing blood and mucus and associated with abdominal pain and tenesmus.

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Examination.—With the onset of this attack an abscess of the liver developed which ruptured into the lungs. Since then the patient had had profuse "anchovy sauce" expectoration, averaging from half to one pint a day. Repeated examinations failed to show the presence of amebas. Tenderness was quite marked over the sigmoid. On admission the temperature was 101. Blood showed an absolute leukocyte-count of 17,900. Stools were thin and watery containing blood-streaked mucus, many actively motile amebas and large numbers of *Cercomonas intestinalis.*

Treatment and Course.—On December 4, 1 dram of ipecac was administered without causing nausea, vomiting or other discomfort. Three stools were voided the following day unattended by pain. Amebas were found which were sluggishly motile. No stool for the next forty hours. The second dose of 1½ drams of ipecac, given December 7, caused slight nausea. The following day the stool was fairly well formed and one motile ameba and numerous cercomonads were found. The general condition of the patient showed improvement, increased appetite, lowered pulse and temperature almost normal. Stool examined December 10 was free from amebas and cercomonads.

December 12, 2 drams of ipecac were administered. This gave rise to considerable nausea and general abdominal pains which lasted about three hours. Repeated examinations of stools for three weeks following showed an absence of amebas and cercomonads. At the end of this time both amebas and cercomonads appeared in large numbers, but disappeared promptly after several ipecac enemas, 2 drams to the pint.

Patient was discharged with normal temperature and almost complete cessation of expectoration. Stools were normal averaging one in twenty-four hours. The accompanying table shows the effect of treatment on the blood with special reference to leukocytes and differential counts.

CASE 6.—*Patient.*—J. P. L., male, aged 30, traveling salesman (referred by Dr. Bunting), contracted dysentery in 1906, while in New Orleans. The symptoms came on abruptly as an acute attack with profuse dark watery stools. The patient was treated in the hospital for seventeen days when the symptoms abated. Since then he has suffered with frequent exacerbations increasing in severity until his admission to Mercy Hospital, Dec. 27, 1911. For a year he had averaged daily from three to eight watery or semisolid stools, containing blood and mucus associated with marked tenesmus. He had been treated with salol-coated pills of ipecac in 1910,

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EFFECT OF IPECAC TREATMENT ON THE BLOOD, WITH SPECIAL REFERENCE TO LEUKOCYTES AND DIFFERENTIAL COUNT IN A CASE OF AMEBIC DYSENTERY (CASE 5)

Date.	Red Count.	Hemoglobin, Per Cent.	White Count.	Polynuc.	Large Monos.	Small Monos.	Eosin.	Remarks.
11/27	.....	..	.....	84	6	10	0	
11/28	.....	..	.....	84	10	6	0	
12/1	3,024,000	43	17,900	78	9	13	0	
12/4	.....	..	.....	..	..	..	.	Ipecac, 1 dr.
12/7	.....	..	.....	..	..	..	.	
12/5	.....	..	.....	84	4	12	0	
12/6	.....	..	12,500	85	5	10	0	
12/8	.....	..	25,000	81	4	15	0	Ipecac, 1½ drs.
12/9	.....	..	17,500	75	5	20	0	
12/11	.....	..	16,000	76	3	21	0	
12/12	3,516,000	..	.....	75	4	20	0	Ipecac, 2 drs.
12/20	.....	..	11,500	79	7	13	1	

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beginning with 50 grains a day the dose being reduced 5 grains daily for two weeks. It was impossible to retain all of the ipecac as it caused vomiting and some of the pills were found in the stools undissolved. Notwithstanding this fact the symptoms were temporarily relieved. In June, 1911, he was again treated with ipecac in keratin-coated pills, 30 grains a day, in addition to opium, bismuth and tannic acid irrigation. The ipecac was vomited either in the form of pills, with the coating dissolved, or disintegrated into a powder. The symptoms were relieved for three or four weeks.

Examination.—Patient appeared slightly anemic, the lymph-nodes of the neck and groin were enlarged and the abdominal wall was soft and relaxed with no rigidity or tenderness on pressure. The liver and spleen were normal. On admission the stools were soft semisolid and revealed microscopically pus cells, active amebas and *Trichomonas intestinalis.*

Treatment and Course.—After nine doses of ipecac the stools gradually became thicker and fewer in number. Administration of the ipecac was followed by little or no discomfort and a gradual diminution of amebas and trichomonads. Proctoscopic examination showed several healing ulcers in the rectum. In this case treatment was discontinued for a while after three administrations of ipecac, but was resumed on return of symptoms, the results proving more successful. The patient left the hospital two weeks after his readmission in fairly good health. At his last report, he had continued to improve in general health, gaining strength and weight with no return of dysenteric symptoms, averaging one normal stool a day with no amebas.

CASE 7.—*Patient.*—F. E. H., male, aged 39, soldier, barber, (referred by Dr. Rosenthal) had unimportant family and previous history. Present condition began in 1900 while in the Philippines. The first attack lasted eighteen days; stools averaged about six per day and contained blood and mucus. The second attack occurred four months later. Since then the patient has suffered with periodical exacerbations and had never enjoyed good health. For the past two years his health was very much impaired. He suffered with abdominal pains, two to six stools a day, frequent chills, fevers and sweats.

Examination.—Patient entered Mercy Hospital Jan. 29, 1912. He was undernourished and anemic. He had marked flattening and relative immobility of lower part of right chest, probably due to an old pleurisy. No râles were heard. There was tenderness over the sigmoid, the liver was slightly enlarged and painful on deep pressure. The lymph-nodes were enlarged.

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Leukocyte count was 13,150. Stools were watery, semisolid and contained blood and mucus with numerous amebas.

Treatment and Course.—He was given six doses of ipecac, 1 dram each, through the tube at intervals of three or four days, which caused some nausea and several attacks of reflex vomiting, but no ipecac was expelled. The stools which after the first examination were loose and watery gradually became well formed. No amebas were found after the first administration. For ten days prior to his discharge from the hospital, February 24, he averaged one normal movement daily. Proctoscopic examination made during the course of treatment showed rapid healing of several ulcers located in the rectum. Since leaving the hospital he has averaged one well-formed stool a day with no further dysenteric symptoms. Examination May 8, 1912, showed stools free from amebas.

It appears from a study of these few cases that the ipecac treatment by duodenal administration is distinctly more efficacious than by other methods. Many other forms of treatment had been employed without avail. The fact that this series of most intractable cases were either permanently cured or relieved for a considerable period of time bespeaks efficiency of the method.

Large duodenal doses of ipecac seem to have no injurious effects. There are occasionally gastro-intestinal symptoms such as nausea, less frequently, vomiting and, rarely, diarrhea lasting from twenty to forty-eight hours. Slight general depression may appear with a tendency to lowering of blood-pressure which rarely amounts to more than 10 mm. even with doses as large as 2 drams. The effect on the leukocyte count, as shown by the accompanying table, is a fair illustration of what occurred in most all of the cases.

In conclusion I desire to acknowledge the valuable services rendered by Drs. Charles E. Simon and A. W. Skilton who examined the stools of my patients and Drs. S. H. Hutchinson and J. V. O'Connor for their clinical assistance in the study of the cases.

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SOME RESULTS OF THE TREATMENT OF THE BALTIMORE DRINKING-WATER BY CALCIUM HYPOCHLORITE*

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AND
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BALTIMORE

The destruction of pathogenic bacteria in drinking-water by means of calcium hypochlorite was first suggested in 1894 by Traube[1], who found that one part of available chlorin in 1,000,000 parts of water would practically sterilize the water in about two hours. This method was applied practically in the Chicago Stock Yards in the fall of 1908; and at about the same time the method was instituted at Boonton in order to purify the drinking-water of Jersey City. This method has since been introduced in many American cities, and the amount of chlorin used has varied from 0.2 part per million to 3.04 parts per million, while the bacterial reduction has varied from 77 per cent. to 99.7 per cent.

METHODS PURSUED IN TREATING THE WATER

The water-supply furnished to Baltimore is obtained by two large impounding reservoirs which collect the water, respectively, of the Gunpowder River and the stream known by the name of Jones Falls. Both of these streams run through a densely populated rural district. The water from each impounding reservoir is then led by a conduit to four storage reservoirs for the

* From the Laboratory of the State and City Boards of Health, Baltimore, Maryland.

1. Traube: Ztschr. f. Hyg., 1894, xvi, 149.

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Loch Raven system and three for the Lake Roland system, and from these storage reservoirs the water is distributed to the citizens.

The application of calcium hypochlorite to the Baltimore drinking-water was begun in connection with the Lake Roland supply, June 7, 1911, and the treatment of the Loch Raven supply was commenced June 22. The amount of hypochlorite as expressed in parts of available chlorin has been gradually increased and the following amounts have been used. The treatment of Lake Roland was begun with 0.6 part of available chlorin per million parts of water June 7, but was reduced to 0.4 part June 19. This amount was again increased in both supplies to 0.6 part per million, July 23; was again increased to 0.75 part per million, August 29, and was finally increased to 1.0 part per million, October 15. April 15, 1912, an order was issued that when the turbidity of the water was over 50, 1.5 parts of available chlorin per million should be used. The hypochlorite solution is added to the water as it flows through the gate chambers of the large impounding reservoirs known as Lake Roland and Loch Raven. The water from the Loch Raven impounding reservoir then flows through a large tunnel or conduit, which is 36,500 feet in length and its area 113 square feet. The water then flows into the first of a series of storage reservoirs known as Lake Montebello; from this reservoir it flows into a second reservoir known as Lake Clifton; from Lake Clifton into a third and a fourth storage reservoir known, respectively, as Lake Guilford and Lake Ashburton. The water from the system is distributed from these last three reservoirs to the citizens.

The water from the impounding reservoir known as Lake Roland flows through the gate chamber into a tunnel or conduit 19,020 feet in length with an area of 25 square feet. This conduit empties into Lake Hampden

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and the water then flows to Druid Lake and the Western High Service reservoir, whence it is distributed to the city mains and taps.

It will be seen from the above description that the water after treatment does not reach the citizen for a period of many days, and under normal conditions when the reservoirs are full this may be as long an interval as two weeks. The time must vary greatly, for we have records showing the beginning of increased turbidity in Lake Roland followed by the appearance of turbid water in the city taps five days later. We also have records showing increased turbidity and high bacterial counts in both impounding reservoirs followed by a corresponding increased count from the city taps in from five to six days. It would seem, therefore, that when the reservoirs are all full of water the water does not reach the consumer until about two weeks later; but when the water in the storage reservoirs is low the treated water may reach the citizen in from five to six days.

A considerable interval of time also elapses between the treatment of the drinking-water and its entrance into the first storage reservoir of either system. Under the normal feed of 60,000,000 gallons per day it requires 12.2 hours for the water to flow from Loch Raven, one of the impounding reservoirs, to Lake Montebello, the first storage reservoir; but under extreme conditions when the storage reservoirs are filled up quickly this time may be reduced to 4.9 hours. Under the normal feed of 10,000,000 gallons per day it takes 8.5 hours for the water to flow from Lake Roland, the other impounding reservoir, to Lake Hampden, the first storage reservoir; but under extreme conditions of rapid filling of the storage reservoir the time may be reduced to 5.7 hours. Except under very unusual conditions the maximum destructive effect of the hypochlorite on the drinking-water takes place in the tunnels leading from the impounding reservoir to the storage reservoirs, as experiments to be described later will show that the maxi-

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mum effect of sterilization is usually achieved in about six hours. This method, therefore, allows the hypochlorite to get in its full effect before the water reaches the storage reservoirs where it undergoes considerable dilution.

DESCRIPTION OF A PERMANENT PLANT FOR THE APPLICATION OF CALCIUM HYPOCHLORITE TO THE WATER

As an example of the method of applying the hypochlorite the following description of the plant used for treating the water from the larger impounding reservoir is given. This is a condensed statement of the description kindly furnished by Mr. Emory Sudler, the engineer of the water department, in charge of the plant.

The plant was located at one end of the opening of a chamber extending down to the mouth of the supply tunnel which carries the water by gravity to the city storage reservoirs 7 miles distant. This plant consists of two solution storage-tanks, a syphon or feed-chamber, and a superimposed mixing tank, all of these being made of concrete. The cylindrical solution storage-tanks have a capacity of 2,200 gallons each and have a concave bottom draining to a slot extending to a 3-inch round hole through the wall of the tank. The supply to the feed chamber is by means of a flange connection located slightly above the edge of the concave bottom, to which is attached a 3-inch rubber hose and valve, the hose being connected to the feed-chamber similarly. The waste or drain is carried by a 3-inch galvanized pipe to a waste chamber in the gate house, whence it flows to a point below the reservoir dam. The siphon, or feed-chamber, is built into one of the angles formed by the joined octagon-shaped solution tanks. In addition to the attachments mentioned above for supplying the solution to this chamber a flange is placed in the center of the bottom of the chamber to which is connected a three-way having a 3-inch valve below it through which the chamber is drained. The other connection to the

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three-way is a 1-inch rubber hose to which is attached the orifice through which the solution is fed to the water-supply as it enters the supply tunnel directly beneath.

The mixing-tank is superimposed over the other angle formed by the joined octagon-shaped storage-tanks and consists of a concrete cylinder. A slot was molded in the center of the bottom of the tank for attaching the stirring apparatus, and pipe connections similar to those in the above were made with the tank, the waste, or drain, being located under the base of the tank and outside the storage-tank, and the supply, or overflow, being flanged to the wall of the tank by expansion bolts about midway of its depth on the center line between the storage-tanks. This has a swivel spout which may be revolved so as to discharge into either storage-tank, and both connections are provided with valves. The working platform is built on a level with the top of the mixing tank for the drums of hypochlorite, and a 2-ton traveling chain-hoist is used for hoisting the drums to the platforms. A gasoline engine pumps water at the rate of from 1,500 to 2,000 gallons per hour to the mixing-tank, the valve being placed on the supply line at the mixing-tank with a relief valve at the pump.

The pump engine also furnished power for the stirring apparatus through reducing gears on a shaft which is belt-driven from a pulley on an engine drive-shaft. An inverted U-shaped iron frame is clamped to the vertical shaft in the mixing-tank, to the prongs of which is attached a cross-arm with six vertical paddles 2½ inches in width and about 18 inches in length bolted to it. These paddles revolve between four baffles of the same dimensions which are secured to the bottom of the tank. The cross-arm of the revolving paddles is prevented from lateral motion by a collar around the pipe which protects the shaft.

The shaft turns in a bronze bearing at the bottom of capped galvanized pipe secured in the bottom of the

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TABLE 1.—LAKE ROLAND SYSTEM *

Month		Average Bacteria per c.c.	Bacteria Reduction	Positive Colon Tests			
				0.01 c.c.	0.1 c.c.	1 c.c.	10 c.c.
1911—	Raw water ..	47,600	.....	.....	60 per cent.	86 per cent.	100 per cent.
July	Storage	725	99.0 per cent.	.....	26 per cent.	57 per cent.	84 per cent.
	City taps	4,410	91.0 per cent.	.....	.....	22 per cent.	64 per cent.
	Raw water ..	38,540	.....	.....	76 per cent.	.....	.....
August	Storage	1,210	97.0 per cent.	.....	32 per cent.	66 per cent.	.....
	City taps	550	99.0 per cent.	.....	3 per cent.	40 per cent.	.....
	Raw water ..	15,095	.....	.....	46 per cent.	80 per cent.	.....
September ...	Storage	286	98.5 per cent.	.....	4 per cent.	31 per cent.	.....
	City taps	170	99.0 per cent.	.....	6 per cent.	30 per cent.	.....
	Raw water ..	17,830	.....	.....	91 per cent.	100 per cent.	.....
October	Storage	457	99.6 per cent.	.....	7 per cent.	37 per cent.	.....
	City taps	538	99.5 per cent.	.....	13 per cent.	33 per cent.	.....
	Raw water ..	58,045	.....	.....	36 per cent.	91 per cent.	.....
November	Storage	627	98.9 per cent.	.....	.....	19 per cent.	.....
	City taps	1,430	97.6 per cent.	.....	4 per cent.	26 per cent.	.....
	Raw water ..	6,540	.....	.....	20 per cent.	35 per cent.	.....
December	Storage	583	91.0 per cent.	.....	.....	12 per cent.	.....
	City taps	642	91.1 per cent.	.....	5 per cent.	10 per cent.	.....
1912—	Raw water ..	22,230	.....	4 per cent.	40 per cent.	76 per cent.	.....
January	Storage	770	96.5 per cent.	.....	.....	28 per cent.	.....
	City taps	1,248	94.4 per cent.	.....	2 per cent.	16 per cent.	.....
	Raw water ..	50,885	.....	.....	40 per cent.	83 per cent.	.....
February	Storage	1,537	97.0 per cent.	.....	.....	27 per cent.	39 per cent.
	City taps	4,238	91.7 per cent.	.....	.....	9 per cent.	57 per cent.
	Raw water ..	40,697	.....	24 per cent.	67 per cent.	.....	.....
March	Storage	4,034	90.1 per cent.	.....	.....	58 per cent.	91 per cent.
	City taps	7,691	81.2 per cent.	.....	.....	16 per cent.	63 per cent.
	Raw water ..	18,727	.....	44 per cent.	90 per cent.	.....	.....
April	Storage	11,533	38.5 per cent.	.....	.....	16 per cent.	72 per cent.
	City taps	43,605	132.2 per cent.†	.....	.....	36 per cent.	50 per cent.

* Available chlorin: 0.4 part per million during June and July; 0.6 part per million during August; 0.75 during September and to October 15; 1.0 from October 15 to April 15; 1.5 from April 15 to June 1, when turbidity reached a point higher than 50. † Increase.

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tank. This pipe affords complete protection to the shaft and bearing. The shaft revolves at about twenty-five revolutions per minute.

The regulating apparatus consists of a float made of concrete plastered on a metal (wire mesh) frame, the dimensions of which are slightly less in plan than those of the siphon or feed-chamber. This is used in that chamber; a wire leads upward from this float to a spirally grooved pulley secured to the roof of the gate-house. This pulley has a sufficient number of grooves to permit the winding of the wire incident to the complete vertical movement of the float and also of another wire leading to a single grooved wheel located over and convenient to the vertical movement of the orifice-hose to which it is attached. The wires being wound on the grooved pulley in the same manner, the float in the chamber and the orifice on the hose move up and down simultaneously.

A counterweight is attached to another grooved pulley which is secured to the same shaft as the one carrying the wire from the float, but the wire to which the counterweight is attached is wound the opposite way from the float wire; this balances the weight of the hose and orifice.

For the adjustment of the head on the orifice, a sliding scale having a thumb-screw clamp is connected between the orifice and the grooved wheel on the wire leading from it.

Attachments for hose connections are provided at four points on the waste or drain piping, so that they may be flushed out when clogged with sediment from the tanks.

BACTERIAL REDUCTION EFFECTED BY THE TREATMENT OF THE BALTIMORE DRINKING-WATER

As has been stated above, the amount of hypochlorite as expressed in parts of available chlorin was increased on several different occasions, and the results as shown by monthly computations indicate that the larger

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TABLE 2.—LOCH RAVEN SYSTEM *

Month		Average Bacteria per c.c.	Bacteria Reduction	Positive Colon Tests			
				0.01 c.c.	0.1 c c.	1 c.c.	10 c.c.
1911—	Raw water ..	60,800	.....	.....	62 per cent.	88 per cent.	100 per cent.
July	Storage	1,835	97.0 per cent.	.....	23 per cent.	56 per cent.	89 per cent.
	City taps	1,580	98.0 per cent.	.....	12 per cent.	29 per cent.	62 per cent.
	Raw water ..	39,560	.....	.....	89 per cent.	.....	.....
August	Storage	2,497	94.0 per cent.	.....	14 per cent.	48 per cent.	.....
	City taps	134	99.5 per cent.	.....	11 per cent.	37 per cent.	.....
	Raw water ..	12,409	.....	.....	74 per cent.	.....	.....
September ...	Storage	754	94.1 per cent.	.....	14 per cent.	39 per cent.	.....
	City taps	336	95.9 per cent.	.....	.....	33 per cent.	.....
	Raw water ..	4,260	.....	.....	82 per cent.	.....	.....
October	Storage	638	98.6 per cent.	.....	13 per cent.	39 per cent.	.....
	City taps	596	99.0 per cent.	.....	2 per cent.	33 per cent.	.....
	Raw water ..	129,996	.....	.....	55 per cent.	.....	.....
November	Storage	1,227	99.1 per cent.	.....	7 per cent.	20 per cent.	.....
	City taps	1,085	99.2 per cent.	.....	8 per cent.	38 per cent.	.....
	Raw water ..	19,313	.....	.....	29 per cent.	92 per cent.	.....
December	Storage	1,916	90.1 per cent.	.....	5 per cent.	22 per cent.	.....
	City taps	1,227	93.7 per cent.	.....	.....	12 per cent.	.....
1912—	Raw water ..	5,577	.....	4 per cent.	15 per cent.	61 per cent.	.....
January	Storage	2,720	51.3 per cent.	.....	.....	4 per cent.	.....
	City taps	3,801	31.9 per cent.	.....	.....	9 per cent.	.....
	Raw water ..	10,238	.....	6 per cent.	25 per cent.	55 per cent.	.....
February	Storage	8,960	12.5 per cent.	.....	.....	.....	.....
	City taps	11,207	9.0 per cent.†	.....	.....	5 per cent.	29 per cent.
	Raw water ..	17,664	.....	.....	71 per cent.	81 per cent.	.....
March	Storage	11,735	33.6 per cent.	.....	.....	25 per cent.	50 per cent.
	City taps	28,639	62.0 per cent.†	.....	.....	15 per cent.	50 per cent.
	Raw water ..	17,310	.....	.....	75 per cent.	100 per cent.	.....
April	Storage	23,276	34.4 per cent.†	.....	.....	41 per cent.	86 per cent.
	City taps	31,825	83.0 per cent.†	.....	.....	77 per cent.	59 per cent.

* Available chlorin: 0.4 part per million during June and July; 0.6 part per million during August; 0.75 during September and to October 15; 1.0 from October 15 to April 15; 1.5 from April 15 to June 1, when turbidity reached a point higher than 50. † Increase.

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amounts of hypochlorite have produced the greater bacterial reduction. The treatment of the water was hardly well under way until about the middle of June, 1911, and the comparative monthly results will therefore be given beginning with the first of July, these being expressed in Tables 1 and 2.

These tables can be consulted in detail for the various monthly averages concerning the reduction in the number of bacteria present in the storage reservoirs and in the city taps. It may be said that from July, 1911, to February, 1912, inclusive, in the water taken from the Lake Roland system the bacterial reduction from the storage reservoirs and from the city taps has varied between 91 and 99 per cent. The presence of the colon bacillus in 0.1 c.c. in the raw water has varied between 90 and 36 per cent., while in the treated water it has varied between 7 and 2 per cent. In 1 c.c. of the raw water the colon bacillus has varied between 100 per cent. of positive tests and 35 per cent., whereas the treated water has varied between 58 and 9 per cent.

In the water from the Loch Raven system during the months of July to December, inclusive, the bacterial reduction has varied between 99 and 90 per cent. The colon bacillus in 0.1 c.c. of the raw water has varied between 89 per cent. of positive tests and 15 per cent. of positive tests, and the treated water has varied between 23 and 0 per cent. In 1 c.c. the percentage of positive tests has varied between 100 and 55 per cent., and in the treated water between 56 and 4 per cent.

The water from the Lake Roland system in March and April has shown a much smaller bacterial reduction and in one case has shown an actual bacterial increase of 132 per cent. During February, March and April the water from the Loch Raven system has shown only a moderate bacterial reduction. The figures in detail can be seen in the table, but the lowest bacterial reduction has been 12 per cent. and the highest 51 per cent. Some of the months show a bacterial increase varying from 9

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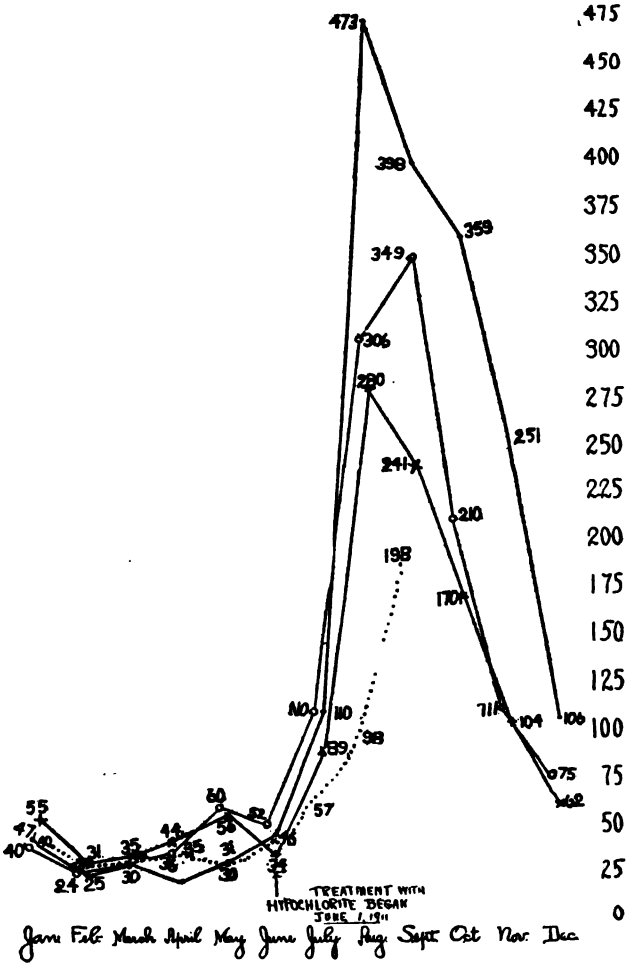

Chart showing cases of typhoid fever reported in Baltimore by months. Cases in 1910 are shown by the line joining solid dots; 1911, by the line joining the crosses; average for five years, 1906-1910, by the line joining the hollow dots; typhoid during the first months of 1912, by the dotted line.

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to 83 per cent. These bacteria which reduce the percentage of reduction or which actually show the bacterial increase or so-called "after-growth" are mainly resistant spore-bearing organisms or a yellow chromogenic bacillus.

Very early in the examination of the treated water we were struck by the large number of positive presumptive tests from which we were unable on plating out to obtain the colon bacillus. We determined, therefore, to examine some of these cultures for the presence of anaerobic, fermenting organisms. In all we have studied forty-four such cultures. These were plated out three times for the colon bacillus, and in no instance was this organism found. On these plates nothing grew save a few spore-bearing organisms of the subtilis type. Anaerobic plates were then made from these fermentation tubes, and from three cultures the *Bacillus sporogenes* was isolated. In six others we found the *B. aerogenes capsulatus.*

On consulting these tables it can be seen that the best results in the elimination of the intestinal organisms from the storage reservoirs and the city taps were obtained after the hypochlorite had been increased so as to represent 1.0 part of available chlorin per million parts of water. The results in the general bacterial reduction are variable, but these have been influenced somewhat by a great increase of the spore-bearing organisms. These so-called "after-growths" may be due to the fact that all of the non-spore-bearing organisms, including the intestinal bacteria, are destroyed, and that the spore-bearing bacteria, deprived of their natural enemies, develop unresisted.

THE INFLUENCE OF THE HYPOCHLORITE TREATMENT IN REDUCING THE TYPHOID MORBIDITY AND MORTALITY IN VARIOUS CITIES

The city of Trenton, according to Hottel,[2] started to purify its water-supply obtained from the raw Delaware River water, Nov. 9, 1911, with calcium hypochlorite.

2. Hottel: Munic. Jour. and Eng., 1912, xxxii, 589.

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TABLE 3.—TYPHOID FEVER IN BALTIMORE, JANUARY, 1907, TO DECEMBER, 1911, SHOWING DECREASE IN MORBIDITY AND MORTALITY SINCE THE USE OF HYPOCHLORITE *

Month	1906		1907		1908		1909		1910		1911		Average 5 Yrs. 1906-1910		1912	
	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths	Case Incidence	Deaths
January	31	12	43	12	47	7	39	16	40	7	55	11	40	10.8	47	9
February	31	6	16	5	26	9	23	3	25	11	31	3	24	6.8	28	7
March	25	6	37	6	36	3	20	5	30	12	35	5	29	6.4	33	11
April	67	11	35	17	24	2	22	4	22	4	44	8	36	11.2	37	10
May	143	12	65	3	40	3	23	5	31	2	56	7	60	5.0	30	8
June	87	5	41	6	47	3	41	6	46	8	34	8	52	4.2	57	3
July	105	14	78	22	149	24	107	11	110	7	89	4	110	15.6	98	15
August	284	34	217	23	339	35	217	20	473	30	280	22	306	28.4	198	22
September	206	32	469	41	364	29	312	24	398	49	241	31	349	35.0	..	..
October	125	26	241	47	187	30	138	23	359	42	170	28	210	33.6	..	..
November	59	15	87	31	99	25	61	10	251	37	104	19	111	23.6	..	..
December	46	10	91	17	68	10	66	9	106	26	62	8	75	14.4	..	..
Total	1,209	183	1,420	230	1,426	180	1,069	136	1,891	235	1,201	154	1,403	192.8	..	..

* Since this article was read we have obtained the records of the typhoid morbidity and mortality for June, July and August, 1912. The figures for these data have been inserted in Table 3 and the record is also indicated in the chart.

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They began with 0.4 part of available chlorin per million parts of water, but this was soon increased to 0.8 part, and has since then varied from 0.8 to 1.0 part per million, with a daily consumption of about 20,000,000 gallons. At this time there was a typhoid epidemic in Trenton, but soon after the hypochlorite treatment was instituted Hottel states that the typhoid dropped abruptly. Quoting his statistics: "During the month of November, 1911, there were eighty-two cases of typhoid reported and during December, forty-nine. For the first three months of 1912 there has been a total of only fifteen cases; in 1911 for the same three months there were fifty-two; in 1910, forty-seven."

The reduction of typhoid fever in Kansas City by the hypochlorite treatment as described by Cross[3] has also been marked. The drinking-water of Kansas City was obtained from the sedimented, but otherwise untreated, Missouri River water; but during 1911 this water was treated with calcium hypochlorite. During the year 1910 there were 107 deaths from typhoid fever, and during the year 1911 only sixty-one. There is a marked difference between the typhoid during January, February and March of 1910 and that for the same months of 1911, the figures for the former three months being seventeen, twenty-one and ten, and for the latter three months six, six and four.

On analyzing the records of typhoid morbidity and mortality for Baltimore, we have thought it best to compare the monthly figures beginning with the year 1906 and ending with the year 1910 with the figures for the corresponding months of 1911 and with those of 1912 up to June 1. Table 3 shows the figures in detail.

"On examining Table 3 it will be seen that the number of cases of typhoid during 1911 is less by 202 than the average number of cases for the past five years, and the deaths are less by thirty-eight than the average number of deaths for the last five years. On examining the comparative figures for 1910

3. Cross: Eng. News, 1912, lxvii, 779.

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and 1911 a much greater difference is observed, for although the reported cases for the first five months in 1911 were nearly double the figures in 1910, yet there is a marked diminution of both cases and deaths beginning with June, when the hypochlorite treatment was begun. The total number of cases for 1910 was 1,891, whereas the total number for 1911 was only 1,201. The total number of deaths for 1910 was 235, whereas the total number of deaths for 1911 was 154. The tables for the last five years certainly show a tendency toward a gradual increase in the cases of typhoid yearly, and this makes the reduction in the cases and deaths for 1911 slightly more favorable, especially when we bear in mind that there has been an estimated increase in the population since 1906 of 25,000."[4]

The number of cases and the deaths for January, February and March, 1912, have not shown the same appreciable reduction, as compared to 1910, 1911, or the average for the past five years. The month of May, however, seems to show a slight reduction as compared to other years, but we can only add that we hope for a similar reduction in typhoid during the summer months of 1912 as we observed during 1911.

The chart shows in a graphic manner the decrease in typhoid cases after the hypochlorite treatment of the water was begun. The lines connecting the solid dots show the number of reported cases by months in Baltimore in 1910. These reach a maximum of 473 cases in August. The lines connecting the hollow dots show the average number of cases by months for the five years from 1906 to 1910. The lines joining crosses show the number of reported cases by months for 1911, and it will be seen that the curve for 1911 remains practically above both of the other lines until June. It then crosses the curves for 1910 and for the monthly average of the past five years and remains well below both throughout the rest of the year. The contrast in the chart is quite striking, and the arrow indicates that the hypochlorite treatment was begun about the first of June. It is just at this point that the morbidity begins to drop and the

4. Am. Jour. Pub. Health., ii, 288.

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curve indicates that it remains below the other lines during the rest of the year.

The dotted line indicates the typhoid cases during the months of 1912, and it will be seen that, while it falls below the record for 1911, it remains above the record for 1910 and the average for the five years from 1906 to 1910 inclusive until April and May; then it falls below the average record of cases from 1906 to 1910, inclusive.

CONCLUSIONS

The results which we have obtained show that the hypochlorite treatment produced a marked diminution of the bacterial content of the treated water until the last two or three months, when we have obtained variable results owing to the after-growth of resistant, spore-bearing organisms. The treatment has also produced an invariable reduction in the percentage of positive tests for the colon bacillus. We have also noted a diminution in the number of cases of typhoid fever during the months of the past summer and fall, but we cannot draw any final conclusions until we have used the treatment for a period of several years.

ABSTRACT OF DISCUSSION

DR. M. L. HOLM, Lansing, Mich.: I represent a state that has more fresh-water frontage than any other state in the Union. Many cities obtain their water-supplies from surface sources, and, in many instances, their sewage is emptied unpurified into the same body of water. Among the cities obtaining their water-supplies from surface sources contamination is the rule; among those obtaining their public supplies from wells, contamination is the exception, barring occasional accidents. Our state board of health statistician recently compiled a table showing the average annual death-rate per 100,000 population from all causes and from typhoid fever in cities of Michigan of 5,000 inhabitants and over for the years 1904-1910, inclusive. There are forty-one such cities; four of them have been eliminated since they include state institutions contributing a proportionately large number of deaths that cannot be separated from those of the cities proper; this leaves thirty-seven cities, twenty-two of which receive their water-supply from surface sources, and fifteen are supplied from wells. The average annual death-

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rates per 100,000 population occurring in these thirty-seven cities, for the years mentioned, are as follows:

	All Causes	Typhoid
Cities supplied by water from surface sources (22)	1,518.7	51.7
Cities supplied by water from wells (15)	1,411.3	25.1
Difference	107.4	26.6

These figures agree, approximately, with what is known as the Mills-Reincke phenomenon and Hazen's theorem and there can be little doubt but that the increased death-rate in the cities supplied by water from surface sources is attributable to the use of contaminated water.

Mechanical filters, when properly constructed and managed, will give at least 98 per cent. bacterial purification, and a reduction in typhoid and general mortality is sure to follow. In a few instances, marked reduction in typhoid and general mortality has not followed the installation of mechanical filters, but this is usually because prior to the installation of the filter-plant the public water was dirty and generally regarded as unsafe. Consequently few people would drink it. After filtration, the general appearance of the water being improved, a greater proportion of the population would use it. If a highly contaminated water receives 98 per cent. purification by mechanical filtration and as a result of such purification proportionately more people drink it there will probably be no marked reduction in general and typhoid mortality.

When mechanical filtration is not sufficient to render the supply safe, it is necessary to employ in addition some method of chemical sterilization. In these instances hypochlorite treatment is especially applicable. The use of ozone in our state has been a failure. Many Michigan cities are using calcium hypochlorite direct without the aid of artificial sedimentation or filtration. This is especially adaptable to the water of the Great Lakes, which is generally quite clear and has a low oxygen consumption. The quantity of hypochlorite required varies with the amount of easily oxidizable material present in the water and must be determined for each individual case. Enough must be added to eliminate all organisms of the colon group and excesses producing marked odor of chlorin should be avoided.

MR. SHEPPARD T. POWELL, Baltimore: A series of experiments to determine the efficiency of hypochlorite of lime as a bacterial agency has been made in the laboratory. It was found that as the turbidity of the untreated water increased, the efficacy of the bleach decreased. From the results of these experiments it was found that it was not advisable to apply more than a 0.1 grain of the chemical per gallon of water filtered (approximately 14 pounds of bleach per million gallons of water); increasing the dose above this amount does not

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give a relatively increased bacterial efficiency. The reason for this is that many of the bacteria present are mechanically protected by the turbidity or matter in suspension, so that the nascent oxygen given off by the hypochlorite does not have access to the organisms and therefore does not act as a bactericide, but is used up in the oxidation of the readily oxidizible organic matter present. This, I believe, is the explanation of the secondary or bacterial growths which are found in the reservoir at Baltimore, after the water has been treated by hypochlorite of lime. The water, as it is treated, often contains high turbidities, much of which is of an organic nature. By treatment with the bleaching-powder many of the organisms present are killed and many are not, and in water with so much organic matter present there is naturally an increased growth in the bacteria that have not been removed during treatment. This, I believe, is the reason for the comparatively low efficiency that has been reported at some places after this treatment, and will account for the failures that will be found in attempting to treat surface water-supplies without filtration.

DR. C. HAMPSON JONES, Baltimore: In order to overcome this difficulty we are now making preparations, through Mr. Whitman, the water engineer, to separate the surface water with alum, and then to have the suspended matter precipitated before it is treated by hypochlorite. A difference of about four days between the two treatments, that is, from the time the water reaches the one point of treatment to the other point of treatment, will demonstrate, I think, the truthfulness of the stand taken by Dr. Stokes.

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AN EPIDEMIC OF TYPHOID FEVER IN PHILADELPHIA

JOSEPH S. NEFF, M.D., LL.D., D.P.H.
PHILADELPHIA

To comprehend fully the epidemic of typhoid fever in a certain restricted area of Philadelphia during December, 1911, and January, 1912, on the introduction of raw river water into the city service pipes, it is well to study the morbidity and mortality for the particular district affected by this epidemic (the Twenty-First, Twenty-Second, parts of the Twenty-Ninth, Thirty-Second, Thirty-Eighth, Forty-Second and Forty-Third wards) and the city at large for a period of years, as given in Table 1.

TABLE 1.—TYPHOID FEVER MORTALITY AND MORBIDITY RATES PER HUNDRED THOUSAND FOR THE ENTIRE CITY OF PHILADELPHIA

	Mortality	Morbidity
1906	72.4	674.7
1907	59.3	460.8
1908	34.8	234.4
1909	21.1	153.5
1910	17.4	112.7
1911	14.1	87.5

The morbidity per hundred thousand population in the district affected, with a population of 291,970, and the rest of the city, with a population of 1,288,280, for the months of December and January, is shown in Table 2.

Under regular operating conditions, water is pumped from the Schuylkill River at Shawmont to the filtration plants at Upper and Lower Roxborough, marked 1 and 2, respectively, on the accompanying map.

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TABLE 2.—COMPARISON OF TYPHOID MORBIDITY IN AFFECTED DISTRICT WITH REST OF CITY DURING DECEMBER AND JANUARY; RATES PER HUNDRED THOUSAND OF POPULATION

December-January	In Affected Districts	In Rest of City
1907-1908.....	61.9	31.3
1908-1909.....	50.5	31.1
1909-1910.....	25.4	16.4
1910-1911.....	11.6	11.6
1911-1912.....	130.0	12.1

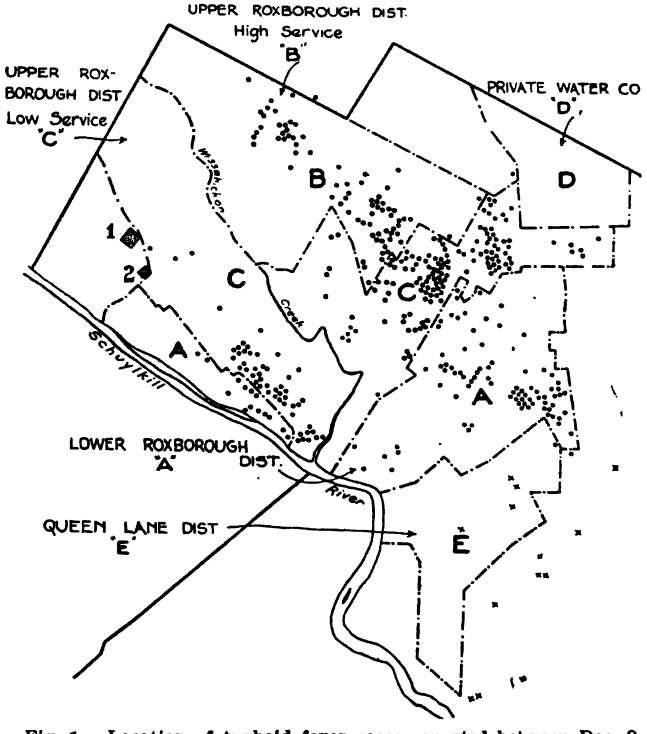

Fig. 1.—Location of typhoid fever cases reported between Dec. 8, 1911, and Feb. 9, 1912, after break in water-main on Nov. 28, 1911. Heavy dots indicate cases in affected districts (367); crosses, cases in adjacent districts.

The main from the pumping station on the river to the Upper Roxborough plant was broken, Nov. 28, 1911, which put both the sedimentation basin and the filter plant out of service until December 6, and, in order to

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furnish the district supplied by this plant, raw river-water was pumped directly into the service mains. The lower plant was not affected.

The district marked A on the map (Fig. 1) was supplied by the Lower Roxborough plant marked 2; the district marked C was supplied by the low-pressure system and that marked B, which is on high ground, by the high-pressure system of the Upper Roxborough plant marked 1. The district marked D was supplied by private water companies; that marked E, by the Queen

TABLE 3.—COMPARISON OF RIVER-WATER WITH THAT IN THE SERVICE PIPES

1911	Bacterial Count		Turbidity
	River-Water, Per c.c.	Upper Roxborough Plant, per c.c.	Parts per Million
November 28	28,000	28,000	17
November 29	51,000	51,000	60
November 30	26,000	26,000	15
December 1	30,000	30,000	9
December 2	18,000	18,000	9
December 3	47,000	47,000	9
December 4	51,000	51,000	10
December 5	22,000	22,000	11
December 6	22,000	22,000	6
Av. for week ending—			
December 9	31,000	180	0
December 16	80,000	160	0
December 23	81,000	250	0
December 30	29,000	42	0
1912			
January 6	11,000	29	0
January 13	7,800	120	0
January 20	18,000	180	0.5
January 27	43,000	80	0

Lane filtration plant, which procured its water from the Schuylkill River, below the intake for the Roxborough plants.

The break in the pipe, November 28, occurred in the main leading to the upper plant. It was of such a character that it washed the earth from under four other mains connected with this station and completely cut off the sedimentation basin from the district marked C and B.

Table 3 shows the bacterial count per cubic centimeter in the river-water daily until the break was repaired and

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weekly thereafter in the river-water and in the service pipes; also the turbidity in the service pipes.

The river-water showed colon bacilli present in 1 c.c. during October, November, December and January. The filtered water in the upper plant showed colon bacilli in 10 c.c. after December 6, in 62 per cent. of samples examined and in January 54 per cent. until the 27th, after which date the results were negative.

The break referred to was repaired December 6 and filtered water again furnished. During the first week of December there was an epidemic of mild diarrhea in the districts marked B and C, as well as a portion of the district marked A, supposed to have been supplied by water from the Lower Roxborough plant, in which typhoid fever later appeared. These cases were not reported to the health authorities, as there was no mortality, and therefore no statistics are available.

Nine cases of typhoid fever were reported from these wards by physicians, December 26, and from that date until the latter part of January, 367 cases were reported; the largest number (sixty-six) in any one day was reported Jan. 2, 1912. This was in part due to the fact that December 31 was a Sunday and January 1 a holiday.

As physicians are undoubtedly lax in performing their full duty to the state and dilatory in promptly reporting cases to the health authorities, often when delay is dangerous, a medical inspection of each case was made to determine the onset and cause of the disease. Figure 2 shows the onset to have preceded the report of the physician from one to two weeks. The greatest number of cases, according to the date of onset, was from twenty-two to twenty-eight days after the break, or from fourteen to twenty days after filtered water replaced the raw water, all of which may possibly have been due to the ingestion of the raw water; but this will not explain the cause of those cases occurring during January, from twenty-two to

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fifty days after filtered water was introduced, unless by continued infection of the pipes, contact or other sources.

Each case was studied to determine this question, and especially those occurring in that portion of the Twenty-Second Ward (marked A on the map), which was supposed to be receiving unpolluted water from the lower plant and the same water which was received in other portions of the section marked A. It was stated that there was no connection between the pipes of this

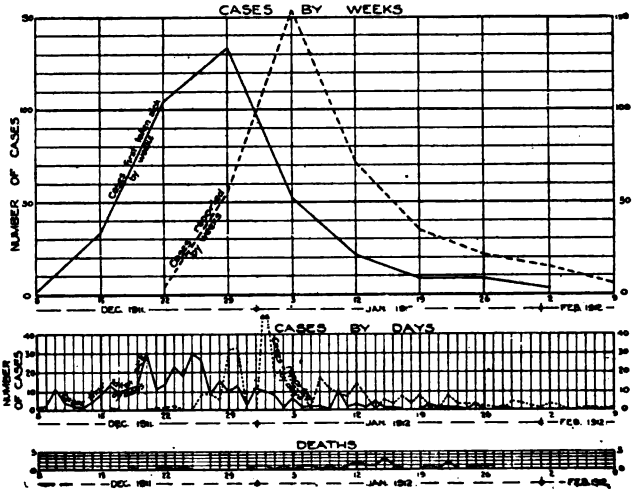

Fig. 2.—Chart showing the interval of time between beginning of cases and reports by physicians.

district and those supplied by mains from the upper plant. Milk was particularly studied from the source of supply to the consumer. No cause could be found outside of water.

A month after the epidemic it was found that an employee of the Water Bureau, to equalize the pressure, opened an emergency valve in the pipe from the upper plant and furnished water to that portion of the Twenty-Second, Thirty-Eighth and Forty-Third wards (marked A), in which numerous cases occurred. In the entire

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epidemic there were 367 cases among people who had not lived outside of the district during the twenty days preceding their illness, in six of which the mother performed the duty of nurse to the first patient and did the cooking and housework. Seven cases could possibly

TABLE 4.—MORBIDITY AND MORTALITY BY AGE PERIODS

Age	Number of Cases	Deaths	Fatalities, Per Cent.
0 to 10.....	79	2	2.5
10 to 20.....	142	7	4.9
20 to 30.....	78	10	12
30 to 40.....	44	2	4.5
40 to 50.....	17	2	11
50 to 60.....	6	1	16
60 to 70.....	2	1	50
70 to 80.....	1	0	0
Total.....	367	25	6.8

have been caused by contact. The dozen or more patients in the Twenty-First Ward (marked A) along the river, living in that portion supplied by the lower plant, worked in the mills, frequently visited or attended

TABLE 5.—THE MORBIDITY BY AGE PERIOD AND WARDS

	Wards							
Age	21	22	29	32	38	42	43	Total
0 to 10	14	48	..	..	6	6	6	80
10 to 20	25	94	1	..	7	9	4	140
20 to 30	14	46	2	..	8	5	1	76
30 to 40	10	22	2	1	5	..	4	44
40 to 50	3	9	..	..	1	1	4	18
50 to 60	1	2	1	..	..	1	1	6
60 to 70	1	1	..	..	..	..	..	2
70 to 80	1	..	..	..	..	..	..	1
Total..	69	222	6	1	27	22	20	367

school in the contagious district supplied by the upper plant.

As there was considerable discussion at the time tending to prove that the epidemic presented some unusual facts concerning age, Tables 4 and 5 have been prepared.

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The explanation offered of the large proportion of cases after filtered water was introduced is that the raw water supplied to the district from November 28 to December 6 was turbid, which, with the frequent newspaper notices to boil the water, prevented many using it as a beverage; but when clear water was reintroduced, December 6, the people, in spite of the newspaper notices, assuming the water to be safe, again used it for ordinary domestic purposes and the remaining infection of the pipes caused the typhoid during the latter part of the epidemic.

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UNIFORM ACCOUNTS AS A BASIS FOR STANDARD FORMS

FOR REPORTING FINANCIAL AND OTHER STATISTICS OF HEALTH DEPARTMENTS

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One of the most important factors in the development of modern medical practice, as in that of every branch of science, has been the classification or systematic arrangement of objects into groups of varying orders which bear definite relations, one to the other, and which thus permit the use of standard and easily understood terms in speaking of or referring to them. Without this classification and the use of standard terms it would be impossible for one physician to describe a disease or to state the results of his research in a new field in terms which others would fully understand. With this classification and use of standard terms every discovery in curative or preventive medicine is readily placed at the disposal of all the people of the civilized nations on the globe.

NEED OF UNIFORMITY IN HEALTH DEPARTMENT REPORTS

To place all their departmental work on the same basis with the science of medicine, health department officials must adopt and use a common classification of their activities and the resulting expenditures, and keep their accounts and other records with reference to these, as they have already adopted standard forms

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for reporting causes of deaths. To be of the highest practical usefulness such a classification must constitute an essential part of the classification of the activities and expenditures of all city departments. To that end the activities of the health and all other departments must be arranged in functional groups that bear the same relations one to the others that orders, genera and species do in the domain of natural science. Thus arranged, accounts and reports will permit the comparison of the experience and expenditures of one city with those of others.

The present monograph is a study in the field of uniform accounting and reporting. It embodies the results of the efforts of the officials of the Bureau of the Census in cooperation with health department officials and others to arrange a scheme of uniform reports that will enable the bureau to compile more comparable health statistics for our American cities, and that will readily permit municipal officials to compare the experience of their city with that of other cities. It is not expected that the scheme here presented is one that can be universally adopted without modification, but it is hoped that it will open the way for the early adoption of uniform health department reports arranged along rational and easily understood lines.

REQUISITES FOR HEALTH DEPARTMENT REPORTS

To make the reports of the health department, or any other city department, of the greatest economic and administrative value, all financial and other data relating to a common subject must be classified and presented along common lines. This requirement is especially necessary in health department reports, since those departments at the present time have a wider range of activities than any of the others. Those activities include work that can properly be spoken of as preventive medicine, and also such service as street-cleaning, refuse-disposal, the administration of medical charity, etc.

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Unless system is adopted in the classification and report of expenditures and work done, a statistical exhibit is presented from which it is impossible to secure any definite statement of the cost of any branch of the service, as can be seen from the following illustration: When horses and automobiles are employed by health departments in connection with the performance of such diverse functions as the care of sick babies and the removal of garbage, no statistics of horses and automobiles can throw any great light on the administration of health departments unless related to the function in connection with which they are employed; and when laboratories are maintained for the study of communicable diseases, the analysis of food and the proper conduct of the work of hospitals, statistics regarding the laboratories must be correlated with the function, or they will be no more significant than statistics failing to distinguish the expenses of horses kept for garbage removal from the expenses of horses kept to enable the doctor to visit a sick baby, or a small-pox patient.

The classification required to make health reports of the greatest value must have as its basis a classification of expenditures. For that reason the reader's attention is first called to a consideration of the essentials for standard forms of financial health department accounts and reports. To secure uniform, and thus comparable, reports of the expenditures of health departments or other branches of municipal service, those reports must be derived from or based on accounts similarly kept; and to secure and maintain such accounts, provision must be made for classifying and recording expenditures along common or standard lines. The outline study here presented, recognizing these facts, is therefore a scheme for uniform accounts and reports based on a suggested standard classification of expenditures, and constitutes a portion of a more comprehensive scheme of uniform accounts and reports for all governmental activities to which the employees of the Bureau

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of the Census, the officers of the National Municipal League, and many other students in this field have given much attention during the last quarter of a century.

EXPENSES AND OUTLAYS

In formulating any scheme or outline of uniform accounts and reports of expenditures that can be of administrative value, expenditures must first of all be segregated into two primary classes according to the life in use of the things for which the expenditures are made. Thus segregated we have: (1) expenses, or costs of current operation and maintenance, and (2) outlays, or costs of permanent properties and equipment.

This classification of governmental expenditures corresponds with the distinction made in commercial accounts between expenses, or revenue expenditures, and capital expenditures. Accounts for one class of expenditures should be kept entirely distinct from those for the other; and in the segregation of items to be recorded in the two classes of accounts, the fact should never be overlooked that the costs for repairs and replacement of buildings and equipment are always to be classed as expenses and not as outlays; and in governmental accounts and reports no segregation of expenses or outlays should be determined by the appropriation from which paid, or the method of financing the same. Without an observance of this rule it is impossible to secure statistics that are comparable as between different municipalities.

BASIS OF CLASSIFYING EXPENSES AND OUTLAYS

The segregation of expenditures into two primary classes of expenses and outlays as above described is one that is of the greatest administrative importance in government as in private business. Such a classification, however, is but the beginning of the segregation that is needed for administrative purposes or for informing the public concerning the work of our health departments

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in their interest. Such a segregation must rest on and bring to the front the things that are common to the health departments of all of our cities. No arbitrary scheme of classification can ever be introduced or accepted by any large number of health officers. Under such circumstances it is well to ask: Do our departments of health have any common units of service or work that can be made the basis of comparable financial and other reports? No such common units can be found in their organization or equipment, since hardly any two of our larger cities have departments with organizations that are even approximately identical. Further, the several departments differ as widely in the field of work covered and in their equipment in the shape of laboratories, hospitals, inspectors, physicians, nurses, etc., as in their organization; and the organization and equipment of all city departments are constantly changing to meet the progressive demands of an enlightened public sentiment relating to the subject. Under these circumstances the only comparable reports of health expenditures and health department activities that can be arranged are those which classify expenses and outlays and all activities according to functions. As a basis for study, it is here suggested that the expenses of health departments be arranged in nine principal groups according to purpose, and that the outlays be arranged in groups to correspond to the classes of expenses. Thus arranged, the nine classes would be given descriptive names and assigned numbers, as follows:

0. General administrative expenses.

1. Expenses for vital statistics.

2. Expenses for treatment and prevention of communicable diseases.

3. Expenses for conservation of child life, or child hygiene.

4. Expenses for food inspection, etc.

5. Expenses for sanitation or promotion of cleanliness.

6. Expenses for general hospitals and care of sick and injured.

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7. Expenses for miscellaneous protection of person and property.

8. Expenses for other activities of health departments.

(For significance of these titles see details included thereunder on pages which follow.)

These nine classes of expenses can readily be arranged in three principal groups, as follows:

A. General administrative expenses, or overhead charges.

B. Functional expenses for activities that directly affect public health.

C. Functional expenses for activities that ordinarily only indirectly affect public health.

The first of these principal groups includes the class of expenses given the number of 0; the second, those numbered 1 to 4, inclusive; the third, those numbered 5, 6, 7, and 8.

Group A includes the expenses that are common to all health departments; group B includes the functional expenses more or less common to all health departments for purposes so directly affecting public health that their results can be measured by changes of death-rates and by the statistics of public school efficiency, and for that reason are coming more and more to be recognized as the principal or primary duties of health departments; while group C includes those that, whether performed by health departments or by other departments or branches of the city government, only indirectly affect public health or affect it so slightly that their results, under ordinary circumstances, cannot be measured by the use of vital or other statistics. Groups A and B make up a group of departmental activities to which the Bureau of the Census gives the designation "conservation of health" and include the municipal activities that are quite generally directed by health departments; while the other group includes activities that are sometimes directed by health departments, but are more frequently under the supervision of other divisions of the city government.

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TABLE 1.—HEALTH DEPARTMENT EXPENSES FOR SPECIFIED PURPOSES IN EIGHT CITIES DURING 1910

Classes of Expenses	New York	Chicago	St. Louis	Minneapolis	Providence, R. I.	Denver	Somerville, Mass.	Davenport, Iowa
Total	$2,479,325	$534,328	$722,447	$116,734	$63,515	$81,532	$91,298	$23,365
Conservation of health	1,571,571	331,607	149,940	43,206	25,932	66,405	20,586	5,435
General administration	170,389	30,486						
Vital statistics	63,610	14,230						
Treatment and prevention of communicable diseases	554,859	199,823	**	**	**	**	**	**
Conservation of child life	579,968	5,925						
Food inspection, etc	202,745	81,143						
Sanitation or promotion of cleanliness	141,182	154,812	†	73,528	27,693	11,227	70,712	17,930
General hospitals and care of sick and injured	544,303‡	21,367‡	431,689‡	.....	.....	.....	.....	.....
Protection of person and property	146,772	.....	.....	§	.....	3,900	§	.....
Other activities of health departments	.....	4,638‖	140,819*	.....	.....	.....	.....	.....
Contingencies (undistributed)	70,497	21,904	.....	.....	9,890	.....	.....	.....

** Not stated separately. † Expenses included with conservation of health. ‡ Including general hospital expenses. § Expenses included with sanitation. ‖ Expenses of lodging-houses. * Poorhouse.

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A careful segregation of health department expenses into the nine principal classes above stated will show at a glance the character of the work being done by or under the direction of and from the appropriations of health departments, and the relative amount expended for each purpose.

As illustrating the great diversity of objects for which the health departments of our cities make expenditures, there is presented for eight cities, ranging from the largest to some of the smallest, as complete a comparative statement of the expenses as it is practicable to make from the printed reports of the cities. For New York and Chicago it was possible to make an approximate distribution of the major portion of the expenses of the nine classes of which previous mention has been made. For the other cities, the expenses of groups 0 to 4 had to be massed under the generic designation "conservation of health." The figures for the eight cities are given in Table 1.

In computing the percentages which the several groups constitute of the whole, there appear the very striking contrasts given in Table 2. In considering these percentages, however, it should be borne in mind that, as shown in the notes to the preceding table, imperfections in the reports of some of the cities result in apparent omissions of some items, and thus the percentages do not correspond to the exact facts.

The percentage which the city expenditures for conservation of health constitute of the total expenditures of the health departments ranged from 20.7 in St. Louis to 81.4 in Denver; and that for sanitation, or promotion of cleanliness, including street sweeping, refuse disposal, and public baths varied from nothing in St. Louis to 63 in Minneapolis, 76.7 in Davenport, and 77.5 in Somerville. The care of the sick in general hospitals, insane hospitals, and for general charity medical service of outdoor poor varied from nothing in the majority of cities to 59.7 per cent in St. Louis. With this statement

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of the need of an intelligent and systematic classification of expenses and services along functional lines, there is presented a suggested outline of accounts which may serve as the basis for comparable and elucidating reports.

TABLE 2.—PERCENTAGES OF THE TOTAL HEALTH DEPARTMENT EXPENSES FOR SPECIFIED PURPOSES IN EIGHT CITIES DURING 1910

Specified Purposes	New York	Chicago	St. Louis	Minneapolis	Providence, R. I.	Denver	Somerville, Mass.	Davenport, Iowa
Conservation of health	65.4	64.7	20.7	37.0	48.4	81.4	22.5	23.3
Sanitation	5.9	30.2	....	63.0	51.6	13.8	77.5	76.7
General hospitals and care of sick and injured	22.6	4.2	59.7	....	....	....	....	....
Other expenses	6.1	0.9	19.6	....	....	4.8	....	....

DIFFERENT ORDERS OF ACCOUNTS

To segregate expenses into the nine groups previously mentioned would require but nine expense accounts, each with the name and number already given, and the report based on the accounts would show under the given heads the amounts expended for each of the nine purposes. But progressive health departments will desire more detailed segregation in their accounting and in their reports; and to assist in such segregation a scheme of uniform accounting and reporting should provide other accounts of subordinate orders in which the items that are properly summed up in the nine principal accounts may be recorded. To provide for this detailed classifying and reporting of health department expenses, the accompanying scheme subdivides the classes of expenses recorded in the one-digit accounts presented above, and gives each subdivision a two-digit number and a descriptive title. The scheme further provides for a still more extensive subdivision of expenses and accounts and the use of three-digit accounts. All two-digit accounts into which a one-digit account may be divided have as their first digit the same figure as the original one-digit

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account, of which they form a part; and similarly all three-digit accounts into which a two-digit account may be divided have as their first two digits the same figures as the original two-digit account; the relations of the subordinate to the superior accounts being indicated as the most convenient by the addition of one or more digits to the number for the subordinate accounts. If greater detail is desired in reports than is indicated by the number of accounts and classes here given, the subdivision of classes and accounts can be carried to any extent desired by the use of columns in ledger accounts or by the use of a fourth and fifth order of accounts that have the same relation of digits, etc., to the accounts here given that those of the third order have to the second and first. The detailed classification of accounts here suggested for consideration is as follows:

SUGGESTED CLASSIFICATION OF EXPENDITURES, AND ACCOUNTS OF DIFFERENT ORDERS FOR RECORDING THEM

EXPENSES

A.—GENERAL EXPENSES, OR OVERHEAD CHARGES

0. General administrative expenses.
   (To include no amounts that can properly be assigned to functional expense accounts.)
   00. Salaries of members of board of health and executive officers.
   01. Salaries of clerks, stenographers, messengers and other general employees.
   02. Printing annual report.
   03. Office supplies, postage, telephone and telegraph.
   04. Rent.
   05. Water, heat and light.
   06. Horses, carriages, automobiles and other transportation for general administration.
   07. Other general expenses.
   (Give in detail if large.)

B.—FUNCTIONAL EXPENSES FOR ACTIVITIES THAT DIRECTLY AFFECT PUBLIC HEALTH

1. Expenses for vital statistics:
   10. Notification and registration of births, and registration of accidents, sickness, deaths, marriages and

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recovery from sickness, and issuing permits for burial and disinterment.

(Division of records.)

11. Tabulation, analysis, interpretation and publication of statistics.

(Division of statistical research.)

12. Regulation of undertakers, morgues, cemeteries, etc.

(Division of mortuary control.)

2. Expenses for treatment and prevention of communicable diseases:

20. Tuberculosis hospitals, patients, etc.—

200. Sanatoriums for incipient cases.

201. Hospitals for advanced cases.

202. Clinics and dispensaries.

203. Physicians, inspectors and nurses in private homes.

204. Ambulance service.

205. Laboratory and research work.

206. Disinfection and renovation.

207. Publicity and educational.

208. All other, including cost of inspection, condemnation and destruction of cows, beef animals, and meat affected with tuberculosis.

21. Hospitals for communicable diseases other than tuberculosis.

(Under this head are to be reported all special hospitals for communicable diseases other than those for the treatment of tuberculosis. Each such special hospital should be reported separately under local name, with description stating classes of diseases treated, each hospital to have a separate account number expressed in three digits.)

22. Other treatment of communicable diseases—

220. Laboratory work in diagnosis.

221. Other laboratory work, including research and preparation of vaccine, antitoxin, etc. (Include in this account, however, no expenses for laboratory work connected with the treatment of tuberculosis, or with milk or food control.)

222. Physicians, inspectors, veterinarians and nurses.

(These are exclusive of those in hospitals or dispensaries, or those employed in connection with tuberculosis, conservation of child life, or to be reported in Account 5. The account should record all expenses incident to the services of physician, inspectors, etc., for vaccine, antitoxins and other remedies.)

223. Publicity and educational.

224. Other treatment of communicable diseases, including ambulance service.

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23. Other prevention of communicable diseases—
  230. Quarantine at home, including reimbursement for loss of wages.
  231. Maritime quarantine.
  232. Disinfection and sterilization.
  233. Campaign for extermination of mosquitoes.
  234. Campaign for extermination of flies.
  235. Campaign for extermination of rats.
  236. Examination of barbers and regulation of barber shops.
  237. Enforcement of spitting ordinance.
  238. Regulation of prostitutes.
  239. Other preventive work of department, including costs of inspection, condemnation, and destruction of horses with glanders, dogs with rabies, etc.

(General sanitary work of the health department which incidentally tends to exterminate mosquitoes, flies and rats, but which does not involve any special effort or special appropriation for the work, should be included as a sanitary expense in a subdivision of general sanitary regulation and inspection, Account 52.)

3. Expenses for conservation of child life:
  30. Medical work for school children—
    300. Sanitary inspection of school buildings.
    301. Inspection of school children by physicians.
    302. Inspection of school children by dentists.
    303. Work of nurses for school children and their families.
    304. General clinical and dispensary work for school children.
    305. Dental clinical and dispensary work for school children.
    306. Publicity and educational.
    307. Other medical work for school children.
  31. Conservation of life of infants—
    310. Supervision and regulation of midwives.
    311. Supervision and regulation of maternity hospitals and lying-in institutions.
    312. Physicians for mother and infant in private homes.
    313. Nurses for mother and infant in private homes.
    314. Clinics and dispensaries for mother and infant.
    315. Milk and pasteurizing stations.
    316. Publicity and educational.
    317. Other conservation of infant life.

(In 31 and subordinate accounts should be recorded all expenses specially directed for lessening infant mortality. In this account should be included no expenses such as those for which Account 30 is designed. The account may be used to include all expenses for con-

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servation of child life other than those to be recorded in Account 30, provided no separation can be made between the expenses for children less than a year old and those above that age. When this separation can be made, the expenses for those less than a year old should be reported in Account 31, and expenses for those above that age in Account 32, although all expenses such as those mentioned in Titles 320, 321 and 322 are to be recorded in those accounts, irrespective of the age of the children.)

32. Other conservation of child life—

(To be reported under specific titles and subtitles, subject to conditions stated above.)

320. Regulation and supervision of the boarding out of children.

321. Regulation and supervision of orphan asylums and day nurseries.

322. Regulation of the employment of children.

323. Sundry expenses for conservation of child life.

(To be reported under specific titles and subtitles, subject to conditions stated above.)

4. Expenses for food inspection, etc.

40. Milk and dairy control—

400. Inspection and tests of herds, and inspection of stables, milk stations, ice-cream factories and milk wagons, and collection of samples of dairy products.

401. Laboratory and research, including tests of dairy products, etc.

402. Publicity and educational.

403. Other milk and dairy control, including the granting of permits to keep cows, and to sell, handle or pasteurize milk.

41. Other food regulation and control—

410. Inspection of all places for sale and manufacture of food, including bakeries, restaurants, and hotels, and the collection of samples of food, drinks, and drugs.

411. Laboratory and research, including tests of all animals for food, and all food, drinks and drugs other than dairy products.

42. Other health conservation, including permits to use wells, laboratory tests of water, etc.; all to be reported under specific titles and subtitles.

C.—EXPENSES FOR ACTIVITIES ONLY INDIRECTLY AFFECTING PUBLIC HEALTH

5. Sanitation, or promotion of cleanliness:

50. Collection of refuse—

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500. Street-cleaning.
501. Collection of garbage.
502. Collection of stable refuse.
503. Collection of ashes and rubbish.
504. Collection of dead animals.
505. Collection of night soil.
506. Collection of refuse under combined system.

51. Disposal of refuse.

52. General sanitary regulation and inspection—

520. Regulation and supervision of scavengers and the collection and disposal of refuse by other departments and by householders.
521. Licensing and inspection of places to keep birds, and animals other than cows.
522. Licensing and regulation of buildings and places that may produce noisome sights and smells, including slaughterhouses, rendering establishments, smokehouses, soap and glue factories, etc.
523. Licensing and inspection of bathing establishments.
524. Prevention and regulation of smoke nuisances, including smoke from automobiles, smoking on cars, etc.
525. Prevention and abolition of other nuisances involving noisome sights, smells, and noises.

(Any important expense under this head should be given a separate report under a descriptive title.)

526. Inspection and regulation of cesspools, vaults, etc.
527. Inspection and regulation of public conveyances.

53. Baths, washhouses and kindred establishments.
54. Public convenience stations.
55-59. Other sanitation or promotion of cleanliness.

(To be reported under specific titles.)

NOTE.—No mention is made of sewers or sewage-disposal since these are seldom under the supervision of health departments.

6. Expenses for general hospitals and care of sick and injured:

60. Emergency hospitals.
61. General hospitals.

(If general hospitals under care of health departments have separate wards for care of those suffering from communicable diseases, the expenses incident to the operation and maintenance of such wards should be separately shown. If more than one hospital is maintained, the expenses of each should be given separately.)

62. Clinics and dispensaries.
63. Physicians and nurses in private homes (exclusive of those whose salaries and expenses are to be reported in accounts 203, 222, 30 and 31).

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64. Ambulance service.

65. Regulation of hospitals and dispensaries.

66. Publicity and educational.

67. Other expenses for sick and injured.

(All amounts here reported should be given in detail after specific titles.)

7. Expenses for miscellaneous protection of person and property:

70. Dwelling and tenement house inspection.

71. Licensing and inspection of lodging-houses.

72. Factory inspection.

73. Examination of plumbers and plumbing inspection.

74. Other building regulation and inspection.

75-76. Other inspections designed to enforce regulations for securing safety to person and good morals, each to be given under specific titles.

(Note distinction between these inspections and those to be reported in Accounts 50, 51, 52, 62 and 63.)

77. Examination of craftsmen other than barbers and plumbers.

(To be given under specific titles.)

78-79. Other general protection of person and property.

(To be given under specific titles.)

8. Expenses for other activities of health department.

(Under this head include expenses for lodging-houses and other institutions operated by health departments that cannot be readily assigned elsewhere under this scheme. All expenses reported under 8 should be given in detail after specific titles, subtitles and account numbers.)

OUTLAYS

9. Outlays:

90. General administrative outlays.

91. Outlays for vital statistics.

92. Outlays for treatment and prevention of communicable diseases.

93. Outlays for conservation of child life.

94. Outlays for general health conservation.

95. Outlays for sanitation.

96. Miscellaneous outlays for sick and injured.

97. Outlays for general protection of person and property.

98. Outlays for laboratories.

99. Outlays for other purposes.

(The foregoing should be given in any desired detail, and accounting may include the use of any desired number of three-digit accounts arranged with reference to the principal classes of outlays, substantially as is shown by the classification and accounts for expenses.)

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DISTRIBUTION ACCOUNTS

The foregoing scheme of uniform classification of accounts for and reports of health department expenditures recognizes the fact that health department laboratories, as their stables and garages, may be employed in doing different classes of work, or work in connection with widely different activities. Their expenses should be distributed according to the activities with which they are associated. To distribute them, the expenses of these incidental operating plants should first be recorded in distribution accounts that will show the complete cost of their operation, and then these costs thus recorded should be distributed to ledger accounts set forth above in detail. In like manner, other distribution accounts should be arranged for use when municipal appropriations are made under heads and titles differing from the classification presented. The appropriation distribution accounts should record the costs incurred in accordance with the terms of the ordinance of appropriation, and classify or distribute them by columns in journal or ledger accounts according to the activity for which expended, and thus provide the data for reports according to functional activity, as called for by the foregoing scheme.

FLEXIBILITY IN CLASSIFICATION

Sanitation, preventive medicine and the other functional activities of modern health departments have had an existence in any systematic form for little, if at all, more than a century. Each year now witnesses the opening of new fields of public health work, and those interested in the welfare of their kind and believing in the possibilities of the future in city life see with the eye of faith still greater progress in the years that are opening. If uniform accounts and reports are to assist in that progress, the accounts and reports must have such flexibility in application as to permit a ready adjustment to all possible changes, and permit the use of the

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scheme in its essential parts by the largest cities with their trained accountants, and by the smallest cities with no ability to command the services of such accountants.

The accomplishment of these results has been kept in mind in the arrangement of the scheme presented. That scheme seeks absolute and approximate comparability for large and small cities with reference only to the principal existing functional activities to which the account numbers 0-8 are given. The large departments with trained accountants and statisticians at their command should have no difficulty in distributing their laboratory, research, stable, transportation, and kindred expenses to all the minor functional activities to which are assigned account numbers of two digits and, if need be, to those of three digits. Those departments should seek uniformity at least in the accounts with two-digit numbers. With the smaller cities and health departments it will doubtless be impracticable, at least for the present, to secure with the class of employees at their command this distribution further than is necessary to obtain comparability for the major functional activities for which the account numbers 0-8 are assigned. Those nine classes of expenses may be made comparable for large and small cities just as the principal receipts, payments, assets and liabilities are comparable for small and large banks, although no such comparability can be secured with reference to the minor details of banking operations.

Within the nine principal groups, the smaller departments may for the present be encouraged to use any classification that will best aid in their own administration and take account of their changing lines of work and investigation. In like manner, the larger departments should be encouraged to make necessary additions to or modifications in the schedule scheme of accounts as they develop new branches of activities not fully described or included in any of the minor titles of the outline. To these new activities and branches of work

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they can assign titles and give account numbers of two digits in their proper relation to the nine principal groups suggested. This provision of the scheme will give all needed flexibility, and at the same time secure comparability so far as comparability in statistics can be of administrative or scientific value.

The account numbers are to be used in accounts, but not in published reports. They are arranged to show the relation of one account to another and the position of each account in the scheme. In practical work, a city will omit all accounts mentioned or suggested when it does not have any expenditure for the activity noted by the title of the account; and the absence of a given title in a report will mark the absence of the activity to which it relates and of an expenditure therefor.

To secure comparability of other health board statistics and to coordinate them with the health department expenditures, all statistics relating to the number of physicians, nurses, inspectors, employees, visits of these employees, number of inspections made, complaints, criminal prosecutions, etc., should be arranged in the nine principal groups with numbers 0-8 and given further classification as is deemed most illuminating by the local authorities. This arrangement of data will more fully disclose the character of the work performed by the several health departments than can be done by any other classification. Further, the statistics of employees, etc., can by this arrangement be correlated with the statistics of expenses and a basis secured for measuring the efficiency of the service and the economy of administration. In this way the health department reports of small and large cities will alike be made more instinct with life by weaving the workers and the results accomplished by them into one connected story. Further, the small health departments, seeing how their activities compare with those of the large departments, will find the needed stimuli to carry into rural sections the modern gospel of sanitation and preventive medicine.

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ABSTRACT OF DISCUSSION

DR. WILLIAM F. SNOW, Sacramento, Cal.: I think it is obvious to all of us who have had anything to do, at least, with the administrative side of public health that what Dr. Powers has said is true, and that if it were possible to have actually in existence such a standard method of accounting, it would be much easier for all of us to make uniform and proper presentation of the practice of health boards when we go before various legislatures and propose asking for the support of the work which we are interested in.

DR. LE GRAND POWERS, Washington, D. C.: In view of the fact that the future will record much progress in preventive medicine, the scheme presented makes provision for adjustment to take account of the changes that will result from that progress. Since there is no common form for making city appropriations for health departments, the scheme outlines a plan for presenting uniform reports with a great variety in methods of making appropriations. It points out how the accountant in keeping record of his expenditures can at once show compliance with the terms of the appropriation acts, however archaic in form, and at the same time give the public, as well as the appropriating body, clean-cut intelligent statements of the work done along standard lines. It shows how this may be done in ways that will make the report comparable with that of all other cities, and will show the cost of each class of work in ways that will disclose something relating to the economy and efficiency of the administration.

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PROCEDURE IN QUARANTINE PRACTICE

DESIRABILITY OF THE RECONSIDERATION OF PRESENT METHODS, ESPECIALLY IN RELATION TO THE "MINOR" INFECTIOUS DISEASES

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Quarantine has been defined as "the adoption of restrictive measures to prevent the introduction of disease from one country or locality to another." In the broader sense, therefore, it includes many measures, following the notification of disease, to prevent the transmission of the infection from the sick to the well. Among these measures may be mentioned placarding of buildings, observation and surveillance of patients and contacts, prohibition of public funerals, disinfection, etc.

In recent times, inquiries have been frequently made to determine the degree of uniformity that prevails regarding restrictive measures and their manner of enforcement by health authorities to prevent the spread of diseases such as diphtheria and scarlet fever. These inquiries disclosed the facts that while placarding, isolation, disinfection and prohibition of public burials were in general insisted on, great differences existed in the provisions governing the character and duration of isolation, because of diversity of opinion with respect to the modes of infection and the period of infectivity.

The object of this paper is not to deal with such measures as placarding, disinfection, etc., in regard to which more or less uniformity exists, but to invite attention to those provisions relating to observation and surveillance of infected and exposed persons.

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REASONABLE AND UNIFORM PROCEDURES

One of the principles governing the conduct of quarantine is that it should be reasonable and based on scientific knowledge respecting the period of infectivity and modes of transmission of communicable diseases. Quarantine of places, persons and things should extend over the least possible period of time consistent with safety, should cause the least possible expense and inconvenience, and should be reasonably effective in preventing the transmission of infection to other localities.

The great importance of reasonable and uniform procedures has led practically all civilized countries to enter into international agreements, in which are specifically outlined the quarantine restrictions to be observed by the respective governments for the control of certain diseases. These diseases are plague, cholera and yellow fever. This international cooperation suggests like action on the part of state and local governments looking to the adoption of definite and uniform methods of procedure in local quarantine practice. That there is need for greater uniformity is evident.

In practically all of the states and territories the duration and conditions of quarantine in different diseases are specified by the regulations of the respective state and territorial boards of health. In certain jurisdictions, on the other hand, such as the District of Columbia, Ohio, Delaware, Idaho and Utah, the duration of quarantine of certain specified diseases is fixed by law. In Iowa quarantine may be imposed only in cases of scarlet fever, small-pox, diphtheria, cholera, leprosy, cerebrospinal meningitis, plague and anterior poliomyelitis.

In all of the states and territories, patients may be quarantined at their residences. In practically all depending on the disease, they may be removed to a special hospital or other place, and in many there is specific authority to establish contagious-disease hospitals. Under certain conditions removal of patients to

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a hospital is made compulsory in certain states, but in Indiana and New Jersey no person may be so removed except on the certificate of two physicians.

In some jurisdictions the duration of quarantine is left to the judgment of the local health authority or physician in charge, and in the several states there are great differences as to the length of isolation in the disease subject to quarantine.

EXISTING REGULATIONS

From a collection of the health laws of the several states and territories which I have made and analyzed to some extent, a striking variation is revealed in the length of quarantine of the minor diseases. A summary of some of these data will be presented to point out such variations and to emphasize the desirability of greater uniformity in view of existing knowledge regarding the causes and methods of transmission of communicable diseases.

Small-pox is usually classed as one of the "major" infectious diseases, but it may be cited as an excellent example of the points that this paper is intended to emphasize. Although the period of incubation has been more definitely determined in this than in most other diseases, the duration of quarantine of exposed persons varies in the several states from ten to twenty-one days, the stated period depending on vaccination and other conditions. Vaccination is recognized by sanitarians generally as a reliable preventive of small-pox, yet in many jurisdictions quarantine of exposed persons is required even after successful vaccination for periods varying from ten to twenty days.

Small-pox patients are also subjected to varying periods of isolation after recovery and disinfection. For instance, in North Dakota it is five days, and in the District of Columbia, sixteen days. In other states numerous periods are fixed from twenty-one to forty days from date of onset, and in still others the time of release is fixed by the health officer or physician.

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Even greater differences exist in the periods during which persons shall be excluded from school on account of small-pox. In all the states, either the laws or the regulations require the exclusion from school of persons from infected premises during the period of quarantine, and in some states the period of exclusion is prolonged for subsequent periods varying from seven to fifty days.

DIPHTHERIA

In the case of diphtheria, which has been declared contagious, infectious or dangerous to the public health in practically all the states and territories, some form of quarantine or isolation is usually required. In a number of states these different forms have been classified as "absolute,"[1] "modified" or "special," the modified form being generally practical even in those states where absolute quarantine is prescribed.

Duration of Isolation of Diphtheria Patients.—In a large number of states and municipalities the period of quarantine of patients is determined preferably by the culture method, but there is variation in the number and time of making the cultures. For instance, in the laws and regulations of eight states examined, two negative cultures are required to be obtained twenty-four hours apart. In five other states only one negative culture is required, in four others two cultures taken two or three days apart, and in three others the number is not specified. Out of twenty cities whose ordinances were examined, ten likewise require two cultures taken twenty-four hours apart, six require one culture, and two do not specify the number or time of taking.

In some of the states and cities the length of quarantine is specified in case cultures are not made. These periods, following the disappearance of all signs of the

1. "Absolute" quarantine implies absolute prohibition of entrance to or exit from quarantined premises. "Modified" quarantine allows, under certain restrictions, the passing in and out of persons in the family. "Special" quarantine merely prohibits the patients from attending public assemblies and sleeping with others, and requires the use of separate eating-utensils, towels, etc.

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disease, are: in one state, five days; in one, fourteen days; in eight, twenty-one days, and in two, twenty-eight days. In other states, in the absence of cultures, the number of days of isolation prescribed dates from the beginning of the illness or report of the case, and is variously stated to be twenty-one, twenty-eight, thirty and forty-two days. In those states and municipalities in which the taking of cultures is not prescribed, the duration of isolation of patients is variously stated to be from ten to thirty-five days from date of onset of the illness or report of the case.

Isolation of Exposed Persons.—In some states, as in Ohio, the duration of isolation of exposed persons is prescribed by law to be the same as for patients. In others the time is fixed by regulation with reference to the last exposure, and is variously stated to be from four to fourteen days. For instance, in North Dakota it is at least four days or until negative cultures are obtained; in Idaho, five days; in Washington, ten days in the case of children, and in Michigan, fourteen days.

Exposed persons usually comprise the members of the family or persons in the house, and in a number of states, as Idaho, Montana, Michigan, North Carolina, South Dakota, Utah and Wisconsin, the length of quarantine applies to all, regardless of age. In other states, children in the same house are isolated for longer periods than are adults. In Virginia, isolation ordinarily applies only to persons under 15 years of age.

In a large number of states, quarantine terminates after death or recovery of the patient and disinfection of the premises; but in some states the time is prolonged in the case of children. In Georgia this additional period of isolation is stated to be seven days after disinfection of the premises. In Indiana and Oregon, children, like adults, may be released following disinfection if they receive an immunizing dose of diphtheria antitoxin of at least 1,000 units. In Iowa quarantine must be prolonged for ten days when children are present

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in the house, unless negative cultures are obtained and the children recently immunized with antitoxin.

Diphtheria serves as a good example of the enforcement of modified quarantine. In many jurisdictions, as Iowa, Minnesota, Nebraska, Pennsylvania and Wyoming, modified quarantine is prescribed in the interest of wage-earners or heads of families working under certain conditions and observing certain precautions.

In Iowa, bread-winners may at the discretion of local health authorities follow their occupations, provided they change clothing on leaving and entering the house, and do not enter the sick-room.

In Nebraska, bread-winners and heads of families, if not teachers or persons associated with children, or employed in the milk industry, may be allowed to follow their vocations, provided they change their clothing on leaving and entering the house, and do not attend public meetings.

In Pennsylvania, wage-earners are allowed to continue work, provided they do not come in contact with the patient or persons caring for him, and provided they are employed in industries other than the production, manufacture or sale of fabrics, wearing apparel, upholstered furniture, foodstuffs, milk, cigars, candies, etc. If so employed, it is specified that they should submit to disinfection and remain away from the premises during quarantine.

In Virginia, all adults over 15 years of age may follow their vocations if not engaged in the production or sale of milk or food, or employed in factories, schools, offices, stores or other places where persons under 15 years are employed, and provided that they do not enter any school, place of public amusement or other place where children are in attendance.

Exclusion From School on Account of Diphtheria.—Exclusion from school on account of diphtheria usually applies to both patient and children and sometimes to adults in the same house. The lack of uniform require-

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ments is striking. The length of time varies according to different state and municipal laws and regulations. According to some the time ends with the removal of quarantine, and according to others, seven, ten, fourteen and even thirty days later. In at least eleven states the period of exclusion extends until the health authorities issue certificates or give permission to return to school. In Porto Rico, such certificate or permission may be issued by the attending physician.

The culture method is apparently prescribed in only a few state regulations as the means to determine the length of exclusion from school. In Massachusetts, convalescents are by regulation permitted to return seven days after the second negative culture has been obtained from the nose and throat and when the physician certifies that all danger has passed; in the case of other children in the house only one negative culture is required.

In cities the culture method appears to be more generally depended on, some allowing school attendance as soon as one or two negative cultures are obtained, others requiring an additional absence for seven days or longer. In Providence, R. I., children in the house are allowed to return after the removal of quarantine; in the better families only one culture is required, and after the expiration of one month all children are usually admitted even if they are bacillus-carriers.

SCARLET FEVER

Scarlet fever, like diphtheria, is subject to control by law or regulations in practically all the states and territories, but the control varies much.

Duration of Isolation of Patients.—In a number of states isolation of patients is required by regulation to be continued until desquamation is complete. In some other states regulations require that quarantine of patients shall continue for varying periods after this event has occurred. In North Dakota it is five days, in

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Maryland seven days, and in Georgia, Idaho, Oregon and South Dakota ten days. In other states, in addition to completion of desquamation, the absence of other symptoms, including disappearance of inflammation of eyes and respiratory tract, or stopping of discharges, is required. In some of these states a minimum time limit is also specified, which is variously stated as twenty-one, thirty, thirty-five and forty-two days.

In those states where a time limit only is specified it is variously stated as twenty-one, thirty, thirty-five, forty-two and forty-nine days. In Delaware and Ohio the time is ten days following terminal disinfection. Regulations in Pennsylvania, in addition to other requirements, specify that the physician must certify in writing that desquamation has ceased and nasal irritation and ear-discharges have healed.

In a considerable number of other states the duration of quarantine is not specified except that it shall continue until death or recovery of the patient, freedom from infection, etc.

Similar variations exist in the requirements of cities studied, the minimum periods of quarantine being variously stated as fourteen, twenty-one, twenty-eight, thirty, thirty-five and forty-two days. In Chicago, in addition to cessation of desquamation and a specified limit of one month, examination by a health inspector is required before removal of quarantine.

A committee on communicable diseases of the American Public Health Association in a report[2] on the practice prevailing in eighty-seven cities in which 52,620 cases of scarlet fever were reported in 1910, states that sixty-four of the cities had a minimum period of quarantine which varied from ten days to six weeks. This report states further as follows:

> In fifty cities the board of health inspects the patient after the report of recovery before release, while the remainder rely on the report of the family physician. The cessation of des-

2. Am. Jour. Pub. Health, 1912, ii, 121.

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quamation is the sign of readiness for release in fifty-nine cities, although fifty-six pay some attention to the condition of the nose and throat. Only four will release a patient when nose and throat appear normal, paying no attention to desquamation, and eleven will release when desquamation has ceased even though a nasal discharge exists.

Quarantine of Exposed Persons.—Quarantine of exposed persons appears usually to apply only to children, but it is stated in the report quoted that in thirty-nine out of eighty-seven cities, all the members of the family are segregated during the continuance of the disease.

In some states, by regulations, quarantine of exposed persons continues during isolation of the patient. These apply in some states, as Illinois and Virginia, only to children, and in others, as Nebraska and Montana, to all persons in the house. In a considerable number of states, modifications similar to those in diphtheria are made in the case of wage-earners. In Iowa the regulations prescribe, in case of death of the patient, that the quarantine of exposed persons shall continue ten days thereafter, if there are children in the family.

Seven, ten and fourteen days after the last exposure are variously prescribed in regulations of other states, but these requirements affect only children, and in North Carolina the requirement does not apply to persons who have had the disease and who submit to disinfection.

In a number of other states, quarantine of exposed persons is by law or regulation extended ten days after recovery of the patient and disinfection. This in some instances applies only to children and in others to all persons in the house. The regulations of Minnesota require extension of quarantine for twenty-one days from the appearance of the last case, wage-earners being exempted as in diphtheria.

Exclusion From School.—In many states, children and sometimes all persons in the house are required to be excluded from school on account of scarlet fever until release of quarantine and presentation of certificate of discharge. In other states, exclusion is continued after

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release of quarantine or disinfection for variously stated periods, as seven, ten, fourteen, twenty-one and thirty days. These requirements in most instances relate to convalescents, but in some, to other children in the house. When exposed persons are removed from the house, the period of exclusion is variously fixed at ten and fourteen days.

When no definite time is fixed, permission for readmittance to school is required to be furnished by the health officer at his discretion.

In the regulations of a number of cities studied, the requirements presumably with respect to convalescents are stated in effect as follows: seven, ten, fourteen and twenty-one days from release of quarantine, and thirty-five and forty-two days from the beginning of the disease. In other cities the period of exclusion, presumably of children in the house, is twenty-eight and forty-two days from the beginning of the last case.

Other variations might be mentioned, but these represent the usual requirements and serve to emphasize the decided lack of uniformity that exists.

MEASLES

In the case of measles, the disease is referred to for purposes of control in the laws and regulations of thirty-four states and territories. The control is in a number of cases limited to the reporting of cases, and in others to requiring placarding or exclusion from school.

Requirements Respecting Isolation of Patients.—Requirements with respect to isolation of patients are variously stated in the above-mentioned laws or regulations. For instance, in Maryland the duration of isolation is stated as fourteen days after the disappearance of the rash; in New Hampshire and North Dakota at least fourteen days presumably from the date of the beginning of quarantine; in Indiana at least fourteen days or until desquamation has ceased; in Missouri, Pennsylvania and Vermont twenty-one days, and in North Carolina

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twenty-eight days. In North Caroline this time may be reduced at the discretion of the health officer. In Vermont it is also stated that quarantine shall continue until all complications are over, and in Pennsylvania, until the physician certifies in writing that the patient is well and that nasal irritation and ear discharges have ceased.

In the District of Columbia, Tennessee and Utah, isolation is specified to be continued until recovery; in New York, until skin and mucous membranes are clear, and in some other states, as Michigan, it terminates at the discretion of the health authority. In Kansas and Virginia, placards only are required.

Quarantine of Exposed Persons.—Quarantine of exposed persons, when required, generally applies to children in the same house, who are usually not allowed to leave it. In North Carolina the period is fixed at fourteen days after the last exposure.

Exclusion From School.—In the case of convalescents, the stated requirements are various. In a number of states, it is provided that they may be readmitted after recovery or release of quarantine. In others, the period is prolonged five, fourteen or twenty-one days beyond such release. In still other states, the duration of exclusion is left to the discretion of the health authority.

In some states, other children in the house are by regulation permitted to attend school if they have had the disease, and there are provisions in several states authorizing children in the same house to attend school ten or fourteen days after removal to another house. In Pennsylvania this applies if the house to which they are removed is occupied only by adults.

In a number of cities, the period of exclusion from school is variously stated as follows: until subsidence of catarrhal symptoms; until recovery or removal from quarantine; seven and fourteen days after recovery; fourteen and twenty-one days from appearance of eruption, and twenty-eight days from beginning of the disease.

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In some of these cities, other children may be readmitted fourteen days from the appearance of the last case in the house, or in twelve or more days after removal to another house.

PRACTICAL APPLICATION OF EPIDEMIOLOGIC AND LABORATORY DATA DESIRABLE

In combating diseases, recourse has been made to isolation to meet not a single condition, but many conditions. It is apparent therefore that some variations will of necessity prevail, but they should be as few as possible and based in so far as practicable on accurate data.

By careful studies, it would be practicable to bring about greater uniformity than at present exists. The results of experiments and laboratory investigations should be utilized, and further investigations made to determine definitely the period of incubation, virulence and viability of infections, modes of transmission, etc., of the diseases in question.

Additional facts and opinions have recently been deduced as a result of laboratory studies and epidemiologic work which would justify some modification of quarantine procedure in certain of the communicable diseases. For instance, Anderson and Goldberger, working in the Hygienic Laboratory, have shown that the period of infectivity of the blood of measles patients begins at least some hours before the eruption appears, and continues for about thirty-six hours thereafter, and that mixed nasal and buccal secretions are infective about the time of the eruption and forty-eight hours later. These observers were unable to infect monkeys with "scales" from measles, and think it highly improbable that desquamated epithelium carries the virus of the disease. Lucas and Prizer have likewise shown that the virus of measles is present in the blood-serum at some time exceeding twenty-four hours before the appearance of the Koplik spots and persists more than

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thirty-six hours after the appearance of the skin eruption. On the basis of this work, it would probably be possible for the quarantine of measles patients to be reduced from the usual period of twenty-one days to not more than fourteen days from the beginning of illness, and probably twelve days. Similar data with respect to other diseases should be brought together and considered with the view to their practical application in quarantine practice.

ABSTRACT OF DISCUSSION

DR. ALEXANDER C. ABBOTT, Philadelphia: Dr. Kerr has shown us that many of our quarantine methods are not in accord with the newest knowledge. In measles, for instance, no account is taken of the latest experimental results. In scarlet fever we still lay stress on the desquamated particles as the carriers, whereas our English confrères have for several years been showing us that the disease is more often spread through discharges from the nose and throat than by scales from the skin. In diphtheria, we rely on two negative cultures as evidence that the convalescent is free from danger, yet we know that this is not a reliable guide. Repeatedly we have observed convalescents at the Philadelphia Hospital for Contagious Diseases whose upper air-passages were free from the germs of diphtheria in so far as could be decided by the ordinary culture methods, yet in many cases there has been a reappearance of the germs in the throats of those patients coincident with catching cold. Obviously the mucous discharges have washed from the crypts of the membranes living bacilli which had been beyond our reach in efforts to detect their presence. The period of quarantine of diphtheria, in localities not possessing advantages of laboratory aid, is usually thirty days. It is of incidental interest to note that the average quarantine period for 5,000 cases taken at random from our case-book, all of which had been released on bacteriologic indications, was twenty-eight days. It should be remarked, however, that such averages are also unsafe guides, as among the 5,000 cases tabulated several were in quarantine for from two to three months and a number for only about a week.

DR. G. T. SCHWARTZ, Providence, R. I.: I doubt if we can get at any common agreement until many of the old traditions of ignorant health officers are wiped away. Until we discard the old idea that long confinement of a case of contagious disease is necessary simply because the disease has lived in the same house with a certain family, we shall still have trouble. The inconvenience is still shown in local boards of health: the medical state officer of one town will quarantine a certain

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case for seven weeks; the neighboring town for three weeks. Both receive censure. It is a question of common sense, whether we are doing what we actually know we ought to do.

DR. B. FRANKLIN ROYER, Harrisburg, Pa.: I want to confirm everything that Dr. Abbott has said with reference to the experience, at least while I was in charge, of the Municipal Hospital in Philadelphia concerning duration of quarantine in diphtheria. While the average quarantine in that hospital is possibly a little longer than we meet in private practice, it might not be amiss to mention that that average duration of quarantine perhaps included all chronic cases, that is, cases with continued irritation of the nasal or buccal mucous membrane or with discharging ears. If the average were taken with that group of cases eliminated (many of them remain six and eight weeks or longer), the average time would be reduced to about twenty-one days. In Pennsylvania we have a minimum limit, which has been fixed by statute, of twenty-one days, except in instances in which two negative cultures have been received on successive days when the time may be as short as fourteen days. Our request for disinfection from the attending physician is framed so as to make him certify that nasal and oral discharges have ceased. In this way it gives a long quarantine for a group of cases that seem to require it, and releases the average case (except in municipalities that may have some additional requirement) at the end of the twenty-one-day period.

The need for uniformity in quarantine regulations has been felt very keenly in Pennsylvania, and with the adoption of the revised act in 1909, certain minimum regulations were fixed for the entire state. There are 875 separate boards of health in the cities, boroughs and first-class townships in this commonwealth and the State Department of Health has direct administrative public health control over about 2,160,000 people scattered through 1,350 second-class townships, and advisory and supervisory control over the remainder of the state. In order to secure uniformity, the very thing that Dr. Kerr is arguing for this morning, a minimum standard, was fixed by the act of 1909; that minimum standard is required of all municipalities in the state; each community, entitled to a board of health, however, being allowed to go as much beyond that minimum requirement as they deem wise. It is very annoying to the state health officer to find a specific regulation in a certain community, and just across an imaginary line, the boundary of that municipality, an entirely different regulation. It is not creditable to public health workers or to the practice of medicine to find these wide variations. As worked out in Pennsylvania by the State Department of Health this standardizing of regulations is improving conditions a great deal, and is giving much greater satisfaction to the public.

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MR. W. A. HOWE, Albany, N. Y.: It is my privilege to be associated with about 1,400 or 1,500 health officers in the state of New York. With them there is no one thing which so frequently occasions trouble and embarrassment in the proper administration of the duties of their office as the establishment and maintenance of proper quarantine over children's diseases. This universal lack of regularity or uniformity of quarantine methods seems to me to be one of the most serious defects of our present system. In my mind we should not only endeavor to adopt a universal state method of quarantining each quarantinable disease, but an interstate system, whereby one state would exert quarantine over the various communicable diseases in precisely the same manner as do the other states. I can see no reason why the quarantine of small-pox, diphtheria or measles should be different in one state from that in another, and I can appreciate many reasons why a uniform period of quarantine and a standard quarantine card should be put in operation in every state. Were the State Department of Health to adopt a uniform quarantine card and furnish the same to the various health officers, who in turn should place such cards on the various communicable diseases reported to them, much of the burden of responsibility would be lifted from the local health officer and his results greatly enhanced.

DR. WILLIAM F. SNOW, Sacramento, Cal.: In California, we felt that we must do something, regardless of what the rest of the country was doing, to put our administration cases on some sort of common-sense basis. Nearly a year ago the State Board of Health appointed a committee of fifteen, which is termed the Committee on Standard Methods of Public Health Administration, and all winter long we have been meeting every little while; we have decided, as a common-sense proposition, to report to the State Board of Health for adoption in our form of rules and regulations next fall a number of things which are very far afield from the type of administrative procedure which we have been accustomed to carry out throughout the country. One simple measure which we proposed to relieve the local health officer from responsibility has been to make certain simple regulations with reference to two negative cultures in diphtheria; when that does not work, the local health officer shall report that case and all other cases that do not fall within the legal ruling to the State Board of Health, so that we may put all those cases that fall outside of simple handling, in the hands of the division of epidemiology for publication.

DR. GEORGE FREDERICK REINHARDT, Berkeley, Cal.: We are trying to get at the question of control of contagious diseases from the point of view of the public. We are trying to convert some of you, ourselves first, before we try it on the public. The difficulty that we are having in dealing with contagious diseases is that medically our methods are arbitrary

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and do not consider the public point of view. We miss a great many cases that are hidden by the public. What states report contagious diseases with any degree of accuracy? Very few of them. So the reports that you read about the number of cases of measles, of diphtheria, scarlet fever are rarely any indication of the number that actually exists. If we can get at the question from the point of view of the public, enlist its interest in our efforts, and then by a process of education point out to it what ought to be done, I think we shall have accomplished a great good. The public is willing, if we will only try to help it; but we have in the past put ourselves in the attitude of policemen in dealing with them, and the result is that we have had opposition. To illustrate what happens: A student made a sanitary survey of Berkeley. In the manufacturing district, where everyone knew there were a great many cases of measles, mumps and chicken-pox and a few cases of scarlet fever, the map showed a very small number, but when he came to trace the deaths from these diseases many were in that district. In the intellectual part of the city he found a large number of cases reported, but a small number of deaths; that showed where there was unintelligent opposition the health office records did not show the facts. We should approach this problem from an educational point of view.

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LAWS RELATIVE TO THE SANITARY CONTROL OF PUBLIC EATING- AND DRINKING-PLACES

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The sanitary knowledge of the ancient Egyptians was tolerably extensive, and, gauged by the measure of those early ages, by no means unimportant. It corresponds to the reality in both the actual and chronologic points of view to consider the Jews (Moses) as creators of public hygiene.

The Egyptian priests bathed their bodies twice every day and twice every night. This was not altogether a priestly custom, for history relates that Pharaoh's daughter bathed daily in the Nile.

The ordinance of Leviticus xv, 11, was made the basis of a sanitary system of ablutions before meals, for which vessels were provided, and further, to secure against defilement in any other way, a system of washing of cups, pots and brazen vessels was devised (Hebrews ix, 9 and Mark vii, 4). In Leviticus xiii and xiv it is noted that the patients' clothing, the vessels they used and the houses they lived in were disinfected. Later St. Mark viii, 4, reads: "And when they come from the market, except they wash, they eat not. And many other things there be, which they have received to hold, as the washing of cups and pots, brazen vessels and of tables."

The rich of Greece (460 B. C.) had their private baths and the Athenians their public baths. The Athenian maiden, unlike her Spartan sister, did not

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think it proper to exhibit her bodily skill and beauty publicly in her chiton, but taking a bath seems to have been one of her every-day habits, as shown by numerous bathing scenes on vases.

When in the Greek home, as guests, persons reclined comfortably at the table and water was poured over the hands and dried with individual towels. Then small portable tables were brought. After the repast was over, the tables were removed, the floor swept clean of crumbs, bones and the like, and once more water was poured over the hands. The use of knives and forks was unknown at this period, whence the custom of washing the hands and drying them on towels.

Roman laws provided no protection for the individual. In older times of Roman history, lavatrinæ or wash-houses were next the kitchen. Later, hot, sudatory, tepid, cold and shower baths were in the homes. At the end, as at the beginning of a meal, the hands were washed with scented soap. The public baths, such as the thermæ of Veleia and Pompeii and the baths of Caracalla, in Rome, (217 B. C.), were masterpieces of architecture. It has been calculated that 62,000 people could have bathed any hour in the public baths of Rome, not to mention the private baths.

Hygienic measures were a part of the religious observances among the ancient Jews, as well as among the peoples of Assyria and India. The measures were enforced by their priests. Among the Greeks this duty was transferred to the physicians. Through the whole, the Jews enjoyed a remarkable immunity from epidemic diseases, while their Christian neighbors perished around them. In medieval and modern history, down to the present time, the filthy habits of the Christian population offered a premium for plagues of every kind. Two centuries ago the mortality of London was eighty per thousand. Until a comparatively recent date the mortality of our large cities compared favorably with the London of two centuries ago.

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The gradual deviation from the sanitary ideals of mosaic times, to the beginning of the twentieth century, was such as to lead to the belief that the standard of civilization was declining, instead of rising. It is not an uncommon thing to see, in the densely populated sections of our large cities, in the small towns and even in country districts, hygienic and sanitary conditions, relative to public eating- and drinking-places, that would put primitive peoples to shame. On a tour of inspection I saw many eating-places where no provisions were made for ablutions before meals. The knives, forks, spoons and dishes (some the cat and dog had used) were rinsed, not washed, in water that had not been changed for days. Among the patrons of these eating-places were whites, blacks and mongols. The diseases represented were tuberculosis, syphilis, gonorrhea, trachoma, scabies, tinea sycosis, and no doubt typhoid, scarlet fever, etc. In another series were found eating-places where provisions were made for ablutions of face and hands but all used the same bowl, towels, soap, etc. The eating- and drinking-vessels were washed in pans, but no attempt was made at sterilization.

In first-class eating-places provision is made for the hygienic and sanitary comfort of the patrons, yet it is the personal element that enters into the protection of the individual in the higher class places.

The standard of public drinking-places may be classed in much the same way as the eating-places, with this exception: even in places of the highest class, glasses and bottles are only occasionally sterilized. In lieu of the foregoing conditions I would suggest the following:

1. The enactment of laws relative to the sanitary condition of public eating- and drinking-places, which shall provide for (a) the personal hygiene of owners and employees and (b) sanitary precaution on the part of owners and employees.

2. The owner of each and every public eating- and drinking-place shall be licensed under such law, such

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license to continue in force as long as there is no violation thereof.

3. Any and every glass, cup, dish and other eating- or drinking-vessel or utensil used in any hotel, saloon, restaurant, drug-store, soda-fountain, or other place of public refreshment in the state shall be sterilized in steam or boiling water after being used by any patron and prior to any further use thereof in eating or drinking by any other patron; and no such glass, cup, dish or other eating- or drinking-vessel or utensil after use by one patron in eating or drinking, shall be offered or be permitted to be used by any other patron without having first been thoroughly cleansed and then sterilized in steam or boiling water.

4. No person, firm or corporation shall at any time or place keep, expose, offer or prepare for sale, or shall store pending sale, any article or substance of human food or drink in any place or premises which is not, at such time, screened so as to prevent insects from having access to such article or substance; and no person, firm or corporation shall at any time or place keep, expose, offer or prepare for sale, or shall store pending sale, any article or substance of human food or drink in any place or premises unless such article or substance is pure and wholesome and entirely free from contagious and infectious bacteria.

5. No drinking-vessel, used in common or to be used in common, shall be kept, exposed, provided or permitted in any railway station, public or private school, public playground, public park, public building or in any place to which the public are admitted.

6. No drinking-vessel used in common shall be exposed, kept, provided or permitted in any mill, factory, railway train, ship, boat, hospital, private or public institution, public works or in any place where a number of persons are employed or assembled.

7. No table-linen or coverings, towels, cloths, sponges, soap, combs or water used in common or to be

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used in common shall be exposed, kept, provided or permitted in any public eating- or drinking-place.

8. No person or persons shall be served food or drink at any public eating- or drinking-place until they shall have thoroughly cleansed the hands and face with soap and water, as provided for in Suggestion 7.

9. No person or persons known to be suffering from an infectious or contagious disease shall be served food or drink at or in any public eating- or drinking-place unless isolated from other patrons under proper sanitary conditions, in order that no other patron shall in any way be exposed or endangered in any manner whatsoever to said infection or contagion.

It may be argued that no sanitary system can supplant present conditions unless entailing great expense and inconvenience. To this I agree; but whatever is humane and promotes the progress of civilization is expedient and necessary. I would therefore suggest the following as a few of the many things that may be used: sanitary paper cups, straws, cupless attachments on faucets, sanitary systems of drinking-fountains in mills, factories, stores, institutions, etc., bubbling fountains, which make cups unnecessary, paper napkins, individual towels, cloths, soap; installation of systems for rapid cleansing and sterilization of dishes, glasses, cups or other utensils, used in or about public eating or drinking places.

Most, if not all, of the state boards of health have condemned the public drinking-cup. The progressive cities have passed ordinances prohibiting the use of the public cup. St. Louis has taken advanced measures to enforce the cleansing of any and every glass, cup, dish and other eating- or drinking-vessel or utensil used in or at any public eating- or drinking-place, in running water or clean water. This ordinance is a great stride in the right direction, but falls far short of the mark.

Railway companies announce that passengers do not demonstrate any great desire for individual sanitary

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cups. Other large corporations maintain that there is no particular benefit derived from the use of the individual cup, and further that the added expense is necessarily great. The same argument comes from the individual in respect to slot machines, paper napkins, etc.

The solution of this great problem of sanitary control of public eating- and drinking-places depends on the elimination of two factors — avarice and ignorance. The mercenary motive of the individual, as regards hygienic and sanitary methods, predominates over his moral obligation to himself and his fellow men. Hence the sequence of his reasoning leads to antagonism of laws respecting sanitary science, basing a great deal on the aphorism that "the Lord giveth and the Lord taketh away." The community reasons that the enactment of laws relative to the control of sanitary conditions brings on it added hardships in the form of increased tax-rate, higher cost of living, physical discomfort and infringement on its personal liberty.

The state, until a comparatively recent date, did not take marked interest in sanitary affairs. It does not at the present time consider seriously the individual. The most notable advances made by the state have been when great commercial interests were endangered. It is said that "Ignorance of the law excuses no one." Such being the case, we have one of two ways of solving a serious problem. The laws must be enacted after the mosaic method and then enforced, which is a most plausible way, or the laws must lie dormant until the masses are educated or have reached a higher standard of civilization.

Realizing that any community that wishes to be prosperous must be healthy, sanitarians have taken the initiative in formulating laws to that end, and have accomplished more for their respective communities than has been achieved in this or any other country in the last 2,000 years. This may seem a broad assertion,

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but is it not true? The brilliant and noble work of Gorgas, White, Blue, Stiles, Sternberg, Wyman, Guiteras, Carroll, Lazear and associates who forged the chain enabling the United States government to have and to hold its many possessions, had the sanction and legal support of the government.

Then must we work and wait until we are in the face of a great commercial enterprise, or until we are in the throes of epidemics of typhoid, diphtheria, scarlet fever, small-pox, cholera, yellow fever or bubonic plague before we awaken to the necessity of legislative measures of sanitary control? No! there is one reality — our duty. It demands of us as medical men and sanitarians to let the light of our knowledge shine and point out the way. Let us blot out the black pages of the last 2,000 years and take up the work that the ancient Babylonians, Jews and Egyptians so nobly began. It is for sanitarians to apply sanitary science to the affairs of civilization; the masses depend on sanitarians for leaders and teachers.

We know what the epidemics of the past have cost us. We know how much we have accomplished and how far we have advanced, but we are not left without a guide. It is true we do not have a Moses to lead us, but we have more in Hurty, Bracken, Evans, Dixon and their kind, great broad-minded men, unselfish, forceful and considerate of the humane advancement of sanitary propaganda. These men have taken the initiative in health work. Now let us have the hearty cooperation of every member of the American Medical Association — every person, it matters not his walk in life, interested in the progress of civilization, in securing for every state in the United States laws relative to the sanitary control of public eating- and drinking- places. It should therefore be our earnest endeavor and duty to make hygiene and sanitary science one of the basic principles of our civilization.

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THE CONTROL OF CONTAGIOUS DISEASES IN A MUNICIPALITY

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Accepting the word "contagious" in its broadest sense, we have a subject before us which would make a better title for a book than for a discussion of this kind, and yet I desire at the start to say that I shall use the word "contagious" as synonymous with "infectious" and "communicable," and speak of contagious diseases as those diseases which are capable of transmitting infection from one person to another in one way or another.

If I had been asked ten years ago to give my opinion as to how to control contagious diseases in a municipality, I would have said "by immunization, isolation and disinfection"; but after more than ten years in this field of work, it would seem that the answer would be even more simple, namely, "by education." It is true to-day, as it was then, that some acute contagious diseases, principally small-pox and diphtheria, are controllable by immunization, the former by vaccination, the latter by the use of diphtheria antitoxin; but in order to get good results from these methods, it is necessary to have the people of a community so educated that they will submit to them readily and whenever the health officer finds it necessary for them to do so. Immunization is undoubtedly valuable in the control of some of the other diseases, among which may be mentioned typhoid fever, but it would be difficult to make any great use of this method in any municipality at the present time because of the lack of knowledge of this procedure on the part of the

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community. Isolation, the second method which has been in vogue for a number of years for the control of contagious diseases, is desirable and satisfactory when it can be employed, but it is necessary first to have knowledge of a case before it can be isolated. It was because of the fact that so many cases of acute contagious diseases, particularly diphtheria, scarlet fever, measles, German measles and others of that nature were never reported and consequently escaped the attention of the public health officials and could not be isolated, that a system now known as medical inspection of school children was first introduced.

Medical inspection of schools, as it is better known, comprises at the present time not only the detection of contagious diseases among school children but also the detection and correction of physical defects and the study of mental defects; but it was originally planned for the purpose of detecting cases which otherwise escaped the attention of the authorities.

In considering the isolation of cases of contagious diseases, the question of hospitalization comes to our mind and with it the fact that many cases of contagious diseases cannot be properly isolated in private houses. I would not take the position that all cases of all contagious diseases, including typhoid and tuberculosis, should be hospitalized, but on the other hand, I think it is absolutely necessary for the success of the preventive measure known as isolation that in each municipality there should be a properly equipped and constructed municipal hospital for contagious diseases under the control of the board of health in which such patients as cannot properly be isolated in their own homes may be cared for. By having facilities for early reception of such patients, it will be possible to reduce not only the morbidity but also the mortality from contagious diseases.

Disinfection is the one method of the three that I have mentioned that has been bitterly attacked by some progressive sanitarians, among whom may be mentioned Dr.

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Charles V. Chapin, of Providence, R. I. In a paper[1] read before the American Public Health Association in 1910, Dr. Chapin took the position that "terminal disinfection," or disinfection of a room or house after a case of contagious disease has been terminated, really has no value, and he showed by a series of figures that in Providence, where "terminal disinfection" had been discontinued, the results obtained with regard to additional cases arising in the houses in which there had been an original case, were almost as good without "terminal disinfection" as when it had been performed. In spite of this opinion, and the opinion of other progressive men, the fact remains that "terminal disinfection," properly done, does disinfect; in other words, that formaldehyd used in sufficient quantities for sufficient lengths of time, in a room which has been properly prepared, does destroy such infection as may be within the room. Of course the method of disinfecting for the purpose of controlling the spread of contagious diseases should not be limited to terminal house disinfection by formaldehyd or sulphur, but should consist in a disinfection during the course of the disease of everything that has been known to have become infected. All materials which have no intrinsic value and which have become infected by contact with the patient during the course of the disease should be destroyed by fire, and whenever this procedure cannot be followed, we should resort to boiling, immersing in chemical solutions, or some other method equally satisfactory.

If it were possible to apply one or more of these methods, namely, immunization, isolation and disinfection, to all of the communicable diseases within a municipality, there can be no question but that the result would be favorable, and the number of cases of such diseases held under control; but considering the appalling ignorance on the part of the public of these diseases

1. Chapin, C. V.: The Value of Terminal Disinfection, Jour. Am. Pub. Health Assn., January, 1911.

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and the manner in which they are spread, we have before us, as I have said earlier in my discussion, a problem of education.

EDUCATION AS TO CONTACT INFECTION

It seems to me that the public health official who hopes to accomplish much in the future in the control of contagious diseases must be the one who will best educate the public in his community in the necessity for such control. In speaking of the need of education among the general public, we must not forget that the medical profession needs some instruction. While it is true that the majority of the profession are in the front rank of our work for the prevention of disease in all of its phases, it is equally true that a good-sized minority are absolutely indifferent and many of them ignorant in this respect.

In the campaign of education which it is necessary to conduct vigorously for the control of contagious diseases, we must first correct some erroneous ideas which have existed in the minds of the public and of some physicians for years. The theory of aerial convection of contagious diseases must be eliminated from their minds, and the fact that all of these diseases are transmitted by direct or indirect contact substituted in its place. So long as the people and many of the medical profession believe that these diseases are spread broadcast through the air, just so long will it be difficult, if not impossible, for us to make much headway in our fight against their spread. Not many years ago nearly all text-books on contagious diseases took the position that while all of these diseases are certainly transmitted by contact directly or indirectly, they may also be carried through the air for a shorter or longer distance. The most modern text-books deny that any of the acute contagious diseases are carried through the air except small-pox, and for some unaccountable reason nearly every author makes an exception when it comes to a consideration of this par-

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ticular disease. As far as my experience goes, I am just as convinced that small-pox is not carried through the air as I am that scarlet fever, diphtheria, measles and other acute contagious diseases are not transmitted in that way. During the winter of 1902-1903 there were 1,023 cases of small-pox in Detroit, and the outbreak began in the Polish district of the city. The cases did not spread from one house to the next as might be expected had they been transmitted through the air, but they went from one family to the family of a friend or relative who lived, in some cases, a short distance, in others a considerable distance away, but had been in contact with the infected household. In this epidemic it was possible to trace the origin of nearly all the cases, and never did we fail to find direct or indirect contact as the cause of the transmission of the disease. According to the old theory, the "striking distance" of small-pox is several thousand feet. During the past ten years we have treated nearly 1,500 cases of this disease at the municipal small-pox hospital; at one time we had 104 patients confined there, and during all of these years we have had but three cases within the reputed "striking distance" of the hospital. These cases were contracted from other cases outside of the hospital with which the patients had, to my personal knowledge, been in contact.

The building which had been occupied in 1902-1903 by this large number of patients with small-pox has since been remodeled and is being used as a tuberculosis sanatorium and hospital, and the small-pox patients are kept in a separate building, but located on the same grounds and not more than 500 feet away. Before this complete change was made, the small-pox patients were confined in one part of the large building and the tuberculosis patients in another part with an air-space of only 3 feet separating the two; during that time, and since then, no case of small-pox has developed on the grounds outside the small-pox hospital, without reference to the vaccina-

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tion status of the patients admitted to the tuberculosis sanatorium.

It is my opinion that not only the acute contagious diseases, including small-pox, are transmitted by direct and indirect contact alone, but that this applies with almost equal force to such diseases as were formerly classed as infectious, of which typhoid fever and tuberculosis are the type. It is undoubtedly true that typhoid epidemics are traceable to infected water- and milk-supplies, but we have cities in which the water-supply and also the milk-supply, as a whole, at least, are beyond suspicion and in which we have every reason to suppose that they are safe as far as typhoid infection is concerned. I believe Detroit is such a city. There may be, and occasionally there are, cases traceable to infected milk from an infected dairy, and I have traced such cases; but as a whole, as I have said, the milk-supply is not infected or we would have many more cases. How, then, is the disease transmitted? In the very interesting and thorough investigation made of the cause of the transmission of typhoid in the United States Army during the time of the late war with Spain by a committee appointed by the government, of which Dr. V. C. Vaughan of the University of Michigan was chairman, the conclusions, as I remember them, were that the disease was spread in three ways, and in the order of frequency they were (1) personal contact, (2) flies, (3) water-supply. All the latest studies of the subject in Germany lean toward the side of direct personal contact rather than the indirect one of transmission by flies and infected water if, indeed, these modes of transmission may be considered "contact," as I would have you believe. Certain it is that no one nowadays adheres to the theory of air-convection as far as typhoid fever is concerned.

With tuberculosis, the proof of "contact infection" may seem even farther away to some than is the case with typhoid, and yet the more this disease is studied, the more evident its method of transmission becomes.

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Not many years ago it was believed that the disease was hereditary, but bacteriology turned on the light and dispelled this erroneous theory. Now we know that consumption is spread from infected persons, principally by the "droplet method," which certainly requires close proximity on the part of the victim, or by means of particles of dried, infected sputum gaining access to the mucous membranes of the mouth and throat of the susceptible individual. But is it not reasonable to believe that in the great majority of cases this infected material may be brought to the lips and mouth of the victim by his own fingers which have become infected in one of the many ways in which this is possible? Or if a man, perchance, carry some infected material on the bottom of his trousers or even on his shoes, and then come into close proximity with these infected articles, is not that contact infection? If consumption were so universally carried through the air as has been supposed, would there not be more cases even than there are now? Certainly not so many of us are immune to the disease.

REPORTING VENEREAL DISEASES

The first step necessary in our campaign of education, then, is to teach the public something about contact infection; and in this instruction we must not forget to lay emphasis on the fact that contact resulting in the spread of the disease may be had not only with the patient himself, but with an infected person or thing; and under this head let us not forget the danger of the ever-present house-fly. The fly that has been in contact with the patient certainly becomes an infected "thing," and one which may be the cause of our taking the disease from which the patient is suffering. As we progress in our campaign of education, it is necessary for us constantly to add to our list diseases to which formerly little attention was paid. In scientific discussions of the past, a fine distinction can always be found between contagious and infectious diseases, and yet there is one class

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of diseases which is certainly contagious, which is dangerous to the public health, and which is perhaps more prevalent than any one of those which have received more attention at our hands and which, until recently, has been mentioned, if at all, only in a whisper. I refer now to the venereal diseases. The time has come when the public must be taught to lay aside false modesty and prudery and must learn something of the terrible results and of the immense mortality following attacks of gonorrhea and syphilis. Here again is an example in which the method of isolation, so highly recommended, has failed utterly in the past because of the fact that the cases are not known to the public health official whose duty it is to isolate them. Each municipality should have a properly equipped hospital for the reception of the most infectious cases of this kind.

In order that cases of venereal diseases may come under control of public health officials, they should be reported just the same as other contagious diseases, but a mere suggestion even to the medical profession that venereal diseases be reported to public health officials encounters disapproval. At a recent meeting of the Michigan Health Officers Association I had occasion to talk on this subject and made the suggestion that the association endeavor to secure legislation during the next year requiring the reporting to public health officials of cases of venereal diseases. The suggestion met vigorous opposition on the ground that physicians would not report such cases and could not be asked to do so. Ten years ago the same opposition was met when it was suggested that tuberculosis be reported. It was argued that the disease was not contagious in the same sense as is, for example, small-pox, that the board of health would isolate all cases and placard the houses, that a patient should not be told when he is suffering from tuberculosis and that the public should not be told about the affliction of the patient. All of these objections have been met and overcome and tuberculosis is now being

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reported, at least, in most cases. In the case of venereal diseases the objections could be even more easily met. The diseases are certainly contagious, as much so as any acute contagious disease that can be mentioned. It will not be necessary to isolate all cases and placard the houses; it is certainly wise and proper to tell a patient when he is suffering from either of these diseases, and as far as the publicity of the report is concerned, that can be overcome in the same way as has been done in laws requiring the reporting of cases of tuberculosis by providing for a protection of the records and making it a violation of the law for the health officer to divulge any of the information contained in the report except for the purpose of enforcing the tuberculosis law itself.

CONTROL OF TUBERCULOSIS

The good results attending the campaign of education for the control of contagion in a municipality are perhaps best seen in the case of tuberculosis. A few years ago this problem looked so large that it seemed impossible to know how to take hold of it; but now the work has become systematized in most cities to such an extent that it is moving along as easily as the work for the prevention of any of the other diseases. In Detroit we had no knowledge of the whereabouts of our cases of tuberculosis until about six years ago. At that time an effort was made to do somthing in the way of the control of this disease, and the first thing necessary was to locate some of the cases. Accordingly, a nurse undertook a house-to-house canvass for the purpose of educating members of the household in the prevalence and danger of tuberculosis and in the methods of its prevention, and incidentally for the purpose of locating some cases of this disease; at the same time a clinic was established in charge of a physician and nurse in the board of health building for the purpose of examining such applicants as might apply, and to give them medical advice and, if necessary, a proper diet. It was not long before a

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number of cases were located, and subsequently the Municipal Sanatorium was started for the reception of the most infectious cases. Now we have nearly 400 patients under the care of the board of health physicians and nurses outside of the sanatorium, and seventy-five constantly receiving sanatorium care. In the meantime and partly as a result of the work done in Detroit, a law was passed by the state legislature providing for the reporting of all cases of tuberculosis in Michigan, and while this law is not being universally obeyed, it has had the effect of adding a great many cases of tuberculosis to the statistics of the departments of health of the state and of the various municipalities, and has given the health officials an opportunity of having general supervision over all these cases.

REDUCTION OF INFANT MORTALITY

Again, the good effect of an educational campaign conducted by the department of public health can perhaps best be seen in the work that is being done all over the country for the reduction of the excessive infant mortality. In Detroit there was a reduction in the number of deaths under 1 year of age during the four summer months, June to September, 1911, as compared with 1910. This reduction was due to a great extent at least to the instructions given by the board of health nurses to mothers on infant hygiene, to the advice and medical attention given babies and mothers in the mothers' clinic at the board of health building, and to the careful supervision of the milk-supply by the milk inspection department. The instruction referred to was given by six nurses who visited the homes when babies were born and told the mothers how to keep the babies well. During the winter months the same nurses act as school nurses in our city; during those months, when it might be expected that it would be easier to reduce the infant mortality, the reduction in 1911 over 1910 was only very slight. During the four summer months there

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were 139 less deaths in 1911 than in 1910 and during the remaining eight months the total reduction was only ninety. This seems to indicate that what is necessary for the promotion of this sort of public health work is instruction, and as far as possible, instruction by word of mouth from the public teacher to the community.

What has been said about the work for the prevention of tuberculosis and for the reduction of infant mortality applies equally well to the restriction of all contagious diseases. It is necessary for a progressive department of public health to have a large corps of competent trained visiting nurses, the larger the number and the more trained, the better. Each case should be promptly reported to the board of health and, after being properly recorded, it should be investigated by a nurse. In her investigation the nurse, besides giving instruction to the family in the prevention of the particular disease, could make a note of the housing condition of the family and in this way this most important branch of public health work would receive proper attention and this predisposing cause of contagious disease — insanitary housing — would be much improved.

In closing I desire to say, as I said in the beginning, that the control of contagious diseases in a municipality must be accomplished by education, and this education can best be given to the public by trained nurses in the employ of the board of health.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. DUTTON AND KIEFER

DR. PAULINE M. TOWNSEND-HANSON, Marshalltown, Iowa: To my mind, the idea of reporting, quarantining and confessing about other diseases and not reporting the social diseases has been a farce for all these years. Who that understands would not rather have small-pox than have one of the venereal diseases? Dr. Dutton suggests laws requiring the cleanliness of patrons at a restaurant before eating their meals, and that all public eating-houses shall have provision made so that the diner may wash up before eating. This we all know would add to the cost of maintaining eating establishments and add

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to the final cost of the meal. Thousands of the well-fed do not realize the effect of 10-cent meals. If any physician of the American Medical Association had to live on 10-cent meals three times a day for a year, that physician would be very apt to feel sick and grievous, but there are thousands of men, women and children who cannot afford ten cents three times a day for a meal. It is a great deal more insanitary to be without a meal entirely than it is to eat a dirty meal. These people who cannot afford the ten or fifteen cents to pay for their meals go to the garbage barrels to find their food, and dirt on the hands is as nothing to the dirt that is found in the food thus gathered. All the dirt on hands which is conveyed to the mouth by the handling of food in eating is as nothing to the dirt that is found in the food during its manufacture from the original products; laws that merely require cleanliness of the things that are going on the table will not touch the problem until there is supervision of food from start of manufacture to eating-time. In connection with this problem, comes the problem of poverty. In this day of speedy processes of manufacture, of increased scientific knowledge and of rapid production, it is a disgrace that we have poverty existing in America, or anywhere else in the world. It is not at all necessary; it is one of the things we have to get rid of, and it is one of the problems for this section to take up. I do not see why we could not have a committee from this section to investigate into the matter of the speediest method of doing away with poverty in America just for sanitary reasons.

DR. OTTO P. GEIER, Cincinnati: Cincinnati is building a municipal hospital which will cost over two million dollars. It was with a great deal of difficulty that a few of us were able to impress on the hospital commissioners that it was safe to place the small-pox hospital near the group of contagious disease buildings. Every speaker this afternoon has emphasized the need of education. Dr. Kiefer speaks about the public teacher. Who is properly the public teacher? Dr. Kiefer says the public teacher should be the nurse. In this crusade of preventive medicine we are gradually narrowing the field of the physician. Most of them are cooperating with the health officer in bringing about this lessening of their field; and it is to their credit. There is a minority who cannot cooperate because with them it is a matter of bread and butter. Possibly in discussing these questions we have overlooked the economic side. Should we not make the physician a part of the program of public educational work? It is said that the average income of the physician in the country to-day is a thousand dollars a year. I would like to suggest this question to Dr. Kiefer. Do we properly value the physician in this program of education? Are we replacing the work which we are taking away from him by preventive medicine? In this campaign of education we must, in self-defense, take care of the

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physician if we care to have this work progress to its ideal limit. If we do so, it will first bring into line that small minority who are fighting for their bread and butter and lastly, I think, it will bring a better recognition from the public itself; because, after all, free service is never appreciated.

MR. W. A. HOWE, Albany, N. Y.: It seems to me we ought to be willing to do more for the general practitioners. They are the men who are suffering most and who will continue to suffer most from this progressive wave of preventive medicine. If we are going to conduct a campaign of education along these lines let us utilize for that purpose the family physician that he may profit rather than suffer therefrom. Let him be the teacher, as he is so well fitted to be, the cooperator, the contributor to our success. Within the last three weeks we have placed in the hands of every member of the graduating class of every medical college of the state, a package of literature bearing on public health. This contains the Public Health Law, various leaflets published by the Department on Communicable diseases and much other material instructive and useful to them as prospective practitioners. We are endeavoring to acquaint them with the various resources of the department and to urge their more liberal employment by the medical profession. We are endeavoring to cultivate a closer cooperative plan between the medical profession and our department, believing that no department of health can be stronger than that which is measured by the willingness of the medical profession in its cooperation. We believe that just in proportion as we can interest the practitioner in our work so are we going to succeed, and that just in proportion as we embarrass the practitioner or discourage him so will success with us be impossible. So thoroughly convinced are we in New York of the necessity of this line of activity that steps have already been taken to introduce into the various medical colleges a uniform course of instruction in public health. This plan has already been approved by the deans of several of our leading medical colleges, and it is my expectation that it will receive their unanimous consent within the next fortnight. Our scheme includes lectures by representatives of the State Department of Health, field instruction to the medical students by the municipal health authorities, and instruction by members of the faculty of the several medical colleges. We also hope to perfect the plan in such a manner that one lecture will be given in each of the ten medical colleges by a representative from each of the other colleges on some subject pertaining to public health. This educational movement among the medical colleges we regard as highly important, believing that by successfully conducting it, within a few years we will secure a large number of medical men trained in at least the rudiments of sanitation, far better capable of making efficient

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health officers and more susceptible of interest in public health questions. This is one of the lines of practical public health instruction which I believe we as health workers must encourage and promote.

DR. SENECA EGBERT, Philadelphia: The question of popular education in public health work is an old one. As a matter of fact it seems to me that we must realize that the greatest field of work is among the laity. Under force and stress of public opinion we have moved our municipal hospital in Philadelphia miles away from the center of the city. It would be much better for Philadelphia if we could have a number of sectional hospitals, each serving its own neighborhood. We might easily enough have these hospitals for infectious diseases if we could get rid of that bugbear in the minds of the people that if there is small-pox or scarlet fever on the other side of the street it is going to be dangerous for people who live on this side. We know that that is largely nonsense. I believe with Dr. Kiefer that the theory of the air transmission of small-pox is largely a fallacy to-day. We owe a great deal to Dr. Chapin of Providence for what he has taught us, although we may not agree with him entirely.

When we can impress on the people the importance of vermin, the fly, the bedbug, etc., and when we can get the public to realize that contagious diseases are transmitted by such agencies or by contact and not by germs floating through the air, then I think we can get people to appreciate what they must do in order to eradicate these diseases; and we can then get to the point where we can have the hospital in the vicinity of the home. One can scarcely blame a mother to-day for objecting to send her child with measles or scarlet fever to a hospital which is possibly a day's travel distant. I am not much in favor of compelling people to do things by law which they do not understand and which they do not want to do. I think we are teaching the people in Philadelphia how to take care of their babies. For instance, Dr. Neff's reports for certain wards show a considerable saving of infant life. It is because the people have been taught, and because many of our health inspectors have been brought into contact with the people and have been able to show them that their neighbors' children were doing the damage in spreading the disease and that they themselves could help in checking it. I know that this matter of popular education will appeal to people if we can put it in the right way. A great many of our social workers are doing splendid work; but we must not forget that not every person can go out and teach health matters without preliminary training; it takes considerable training before people are able not only to teach but to get those whom they are teaching to absorb and apply what is taught.

DR. MARY DUNNING ROSE, New York: Nurses will work for $1,000 a year or less and give their entire time. If physicians

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were asked to do for $1,000 a year the district work which these nurses are doing, and devote their time to it, I think that but few would respond to the call. Again, if the number of physicians who register in the United States continues to diminish—there were more than a thousand less in 1911 than in 1910—it seems as though it will not be many years before physicians will be able to obtain more than $1,000 a year, even though preventive medicine is pushed forward as rapidly as possible.

DR. WALTON FOREST DUTTON, Carnegie, Pa.: I do not think the scope covered by my paper was at all too broad. The suggestions relative to the sanitary control of public eating- and drinking-places are appropriate to present-day conditions. If we will stop and consider just for a moment, we fully realize the necessity for such laws as I have advocated. Since this paper was written, four cases of gonorrheal ophthalmia have come under my service. The infection was directly traceable to a towel used in common by the men and boys employed in a certain part of a mill. Another patient employed in a down-town office gave about the same history.

Some days ago while drinking at a soda fountain, I saw the same glass and spoon which had been used by a person who had a chancre at the angle of the mouth, rinsed off hurriedly, not washed, and placed on the working board. Ten minutes later I saw the same glass, and spoon, filled and handed over to a little girl about 10 years of age. In the name of Him who said "Suffer the little children to come unto me," is there no help? Must we work and wait on the education of the masses and in the meantime sacrifice the lives of thousands of men, women and children to years of loathsome disease, suffering and death?

For the sake of the innocent mother, sister or child in your own home or that of your brother who must of necessity patronize public eating- and drinking-places, assist in enacting laws which will be an honor to yourself, to your neighbor and to your country.

DR. GUY L. KIEFER, Detroit: I agree with Dr. Howe in his statement that the principal thing necessary for the success of public health and work is the cooperation of physicians, and, of course, the cooperation of the people. There is no question about that. I desire to emphasize what I have said about employing nurses as teachers. In the first place, as Dr. Rose said, you cannot get many physicians to devote all of their time to the work for $900 a year; in the second place, the more of this educational work there is done, the more successful your public health work and the more business you make for the physicians. There are always going to be people in every community who are going to employ the physician to do the very thing that the nurse is doing through the public health department. I agree absolutely that sanitary educa-

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tion is better than sanitary legislation. You cannot enforce legislation unless you have the education and the public sentiment back of your laws; but the way to give the people this education is by sending a nurse to the house, because, while the physician might in many cases be more able to give knowledge, people will not listen to him as they will to the nurse. The nurse goes to the home and talks to the mother, who will not listen to the physician. If physicians go around giving this education, the physicians at large will think that the former are getting into their families, and there is the question of professional jealousy.

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THE HYGIENE OF SWIMMING-POOLS

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The care of swimming-pools in educational institutions and athletic clubs has of late years attracted considerable attention. Notable studies have been made, among which may be especially mentioned those at Brown University, and by Dr. William J. Lyster at the University of Pennsylvania. Gymnasia which are frequented by a large number of persons may act as foci of infection. It seems possible that a swimming-pool with a limited supply of water, when used by a large number of persons, may serve to convey from one to the other pathogenic organisms. In this connection the danger from typhoid fever seems to attract the attention of many people. There is no doubt that contaminated water may produce this disease in swimmers as the water is not infrequently taken into the mouth.

The men's gymnasium at the University of Wisconsin is much overcrowded and it was felt that a study of conditions as found in both the men's and the women's pools would be of unusual benefit. This was undertaken by the hygienic laboratory, and the work was done mainly by Mr. E. J. Tully, the chemist of the laboratory. Both chemical and bacteriologic analyses were made. A study has been made of the increasing contamination of the pools between the changes of water, and also the value of hypochlorite of lime in controlling the bacterial conditions. The methods followed in the analyses were those laid down by the Committee on Standard Methods

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for Water Analysis of the American Public Health Association.

The swimming-pool in the men's gymnasium is 80 feet long, 20 feet wide, and ranges from 4 feet to 10 feet in depth with a capacity of 97,000 gallons, approximately. The tank is emptied, cleaned, and filled with water from Lake Mendota once each week. The lake water is warmed during the winter and maintained at a temperature of 70 F. Approximately 275 men use the tank each day until Saturday, when the number is much increased. The bathers are required to take a shower-bath before entering the pool.

The swimming-pool in the women's gymnasium is 60 feet long, 20 feet wide and ranges from 3½ feet to 7 feet in depth, its capacity being approximately 70,000 gallons. Water from Lake Mendota is used in this tank also, but is filtered through coke and scrap-iron before entering the pool. The pool is emptied each Friday and the tank allowed to air until Monday, when it is refilled, and bathing begins Monday afternoon. The water is kept at a temperature of from 75 to 80 F. Only about fifty persons use the tank per day, and every person is required to take a shower-bath before entering the pool. Lake Mendota is rich in lower plant life and during the summer the water often acquires a disagreeable smell on account of these vegetable growths. Formerly much sewage from the city of Madison and lake shore settlements emptied into the lake and several outbreaks of typhoid fever have occurred which were attributed to the use of lake water. Of late years septic tanks and filter-beds have been used and this condition has been much improved. A large number of examinations were made, only some of which are presented here, but these are typical of all. Bacteriologic and chemical analyses were made of the boys' tank in January, March and April, 1910, and in January and February, 1911; samples were collected in the girls' swimming-pool during the same months of 1911. In 1911 and 1912 experiments with

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hypochlorite of lime were carried out, as is shown by the table. Control samples were taken from the inflow pipe at the same time that the samples from the tank were taken.

The first series of examinations was made in January, 1910. Two samples were collected daily, morning and afternoon. The plating and inoculations of the fermentation tubes were done within fifteen to thirty minutes after the taking of the samples.

Table 1 gives the results of the first series of examinations from Jan. 18 to Jan. 29, 1910.

TABLE 1.—BACTERIOLOGIC EXAMINATIONS OF WATER FROM BOYS' SWIMMING-POOL

Sample	Date	Hour	Gelatin Count per c.c.	Agar Count per c.c.	B. Coli Present in			Chlorin in p. p. m.
					0.1 c.c.	1 c.c.	10 c.c.	
Pipe	1/18/10	4 p.m.	150	5	—	—	+	1.4
Tank	1/19/10	10 a.m.	455	349	—	—	+	1.4
Tank	1/19/10	4 p.m.	5,100	920	—	—	+	1.5
Tank	1/20/10	10 a.m.	29,600	3,600	—	—	+	1.4
Tank	1/20/10	4 p.m.	114,800	1,350	—	—	—	1.4
Tank	1/21/10	10 a.m.	1,400	440	—	—	+	1.6
Tank	1/21/10	4 p.m.	540	440	—	—	+	1.8
Tank	1/22/10	10 a.m.	620	220	—	—	+	2.1
Tank	1/22/10	4 p.m.	1,260	575	—	—	+	2.1
Pipe	1/24/10	4 p.m.	30	18	—	—	+	1.1
Tank	1/25/10	10 a.m.	163	420	—	—	+	1.1
Tank	1/26/10	10 a.m.	1,470	500	—	—	+	1.1
Tank	1/26/10	4 p.m.	21,970	660	—	—	+	1.2
Tank	1/27/10	10 a.m.	16,900	1,550	—	+	+	1.2
Tank	1/27/10	4 p.m.	9,700	...	—	+	+	1.2
Tank	1/28/10	10 a.m.	1,280	240	—	+	—	1.2
Tank	1/28/10	4 p.m.	380	270	—	—	+	1.3
Tank	1/29/10	10 a.m.	590	128	—	—	—	1.8
Tank	1/29/10	4 p.m.	1,560	405	—	+	+	2.0

The results show that the number of bacteria gradually increases, the maximum being reached about the middle of the week, followed by a decrease until Saturday, when a considerable increase is again apparent. This is probably due to the large number of bathers using the tank on Saturday. The colon bacillus is usually present in 10 c.c., and sometimes in 1 c.c. of lake water. During the two weeks of this examination the colon bacillus was generally present in 10 c.c. and only

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occasionally in 1 c.c. of the tank water. The increase in the chlorin content was slight. In all the examinations the chlorin content showed very slight increase.

Table 2 gives the bacteriologic and chemical results for the week of Jan. 16, 1911. The fluctuation in the number of bacteria is closely similar to that shown in Table 1, and the amount of chlorin corresponds closely. The chemical analyses show a small but gradual increase

TABLE 2.—BACTERIOLOGIC EXAMINATIONS OF WATER FROM BOYS' SWIMMING-POOL

Sample	Date	Hour	Gelatin Count per c.c.	Agar Count per c.c.	B. Coli Present in			Chlorin in p. p. m.
					0.1 c.c.	1 c.c.	10 c.c.	
Pipe	1/16/11	4 p.m.	440	5	—	—	+	1.0
Tank	1/17/11	10 a.m.	1,200	910	—	—	—	...
Tank	1/17/11	4 p.m.	14,000	770	—	+	+	1.2
Tank	1/18/11	10 a.m.	22,500	2,250	—	—	+	...
Tank	1/18/11	4 p.m.	13,500	3,010	—	+	+	1.1
Tank	1/19/11	10 a.m.	8,600	1,900	+	—	+	...
Tank	1/19/11	4 p.m.	10,760	1,900	—	—	+	1.2
Tank	1/20/11	10 a.m.	3,050	1,410	—	—	+	...
Tank	1/20/11	4 p.m.	4,500	900	—	—	+	1.6
Tank	1/21/11	10 a.m.	620	120	—	—	—	...
Tank	1/21/11	4 p.m.	1,600	538	—	—	+	2.0

CHEMICAL ANALYSES

Sample	Date	Hour	N as Free NH_3	N as Alb. NH_3	N as NO_2	N as NO_3	Total	Chlorin in p. p. m.
Pipe	1/16/11	4 p.m.	0.118	0.274	0.003	0.02	0.415	0.8
Tank	1/17/11	10 a.m.	0.156	0.276	0.005	0.03	0.467	0.4
Tank	1/18/11	10 a.m.	0.176	0.380	0.007	0.03	0.593	1.7
Tank	1/19/11	10 a.m.	0.180	0.400	0.012	0.025	0.617	2.2
Tank	1/20/11	10 a.m.	0.250	0.380	0.025	0.03	0.685	2.1
Tank	1/21/11	10 a.m.	0.220	0.420	0.022	0.03	0.692	2.8

in free ammonia, albuminoid ammonia, nitrites and total nitrogen. The amount of nitrogen as nitrates remains constant, while the chlorin increases slightly. In general, the chemical results show the presence of considerable nitrogenous organic material in the lake water, and the initial increase in the number of bacteria present is due, no doubt, to the natural growth of bacteria in a favorable environment, and is probably not caused to

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TABLE 3.—BACTERIOLOGIC EXAMINATIONS OF WATER FROM GIRLS' SWIMMING-POOL

Sample	Date	Hour	Counts on Gelatin per c.c.	Count on Agar per c.c.	Gas in Dextrose Broth			B. Coli Present in		
					0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
Pipe	1/23/11	4 p.m.	260	10	—	—	+	—	—	+
Tank	1/23/11	4 p.m.	570	35	—	—	+	—	—	+
Tank	1/24/11	11 a.m.	1,680	46	—	—	+	—	—	+
Tank	1/25/11	11 a.m.	2,300	47	—	—	+	—	—	—
Tank	1/26/11	11 a.m.	2,200	30	—	—	+	—	—	—
Tank	1/27/11	11 a.m.	4,250	29	—	—	—	—	—	—

CHEMICAL ANALYSES

Sample	Date	Hour	N as Free NH_3	N as Alb. NH_3	N as NO_2	N as NO_3	Total	Chlorin in p. p. m.
Pipe	1/23/11	4 p.m.	0.128	0.328	0.002	0.01	0.468	1.6
Tank	1/23/11	11 a.m.	0.020	0.310	0.010	0.04	0.380	2.2
Tank	1/24/11	11 a.m.	0.045	0.300	0.010	0.06	0.415	1.5
Tank	1/25/11	11 a.m.	0.060	0.460	0.011	0.05	0.581	3.2
Tank	1/26/11	11 a.m.	0.140	0.580	0.016	0.05	0.786	3.3
Tank	1/27/11	11 a.m.	0.080	0.330	0.018	0.07	0.498	2.4

TABLE 4.—BACTERIOLOGIC EXAMINATIONS OF WATER FROM GIRLS' SWIMMING-POOL

Sample	Date	Hour	Counts on Gelatin per c.c.	Count on Agar per c.c.	Gas in Dextrose Broth			B. Coli Present in		
					0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
Pipe	2/ 6 /11	11 a.m.	425	17	—	—	+	—	—	+
Tank	2/ 6 /11	11 a.m.	4,400	48	—	—	—	—	—	—
Tank	2/ 7 /11	11 a.m.	4,250	34	—	—	—	—	—	—
Tank	2/ 8 /11	11 a.m.	4,600	123	—	—	—	—	—	—
Tank	2/ 9 /11	11 a.m.	2,100	10	—	—	+	—	—	—
Tank	2/10/11	11 a.m.	2,750	6	—	—	+	—	—	+

CHEMICAL ANALYSES

Sample	Date	Hour	N as Free NH_3	N as Alb. NH_3	N as NO_2	N as NO_3	Total	Chlorin in p. p. m.
Pipe	2/ 6 /11	11 a.m.	0.070	0.230	0.002	0.05	0.352	2.1
Tank	2/ 6 /11	11 a.m.	0.005	0.290	0.006	0.10	0.401	2.8
Tank	2/ 7 /11	11 a.m.	0.010	0.300	0.007	0.08	0.397	1.7
Tank	2/ 8 /11	11 a.m.	0.010	0.260	0.006	0.06	0.336	1.9
Tank	2/ 9 /11	11 a.m.	0.005	0.280	0.007	0.07	0.362	2.1
Tank	2/10/11	11 a.m.	0.100	0.160	0.007	0.08	0.347	2.2

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any considerable extent by the addition of polluted material. As the amount of chlorin present is about the same, there is here also little evidence of additional pollution. The examinations showed that the hygienic condition of the boys' swimming-pool was generally very good.

Tables 3 and 4 give the results of the examinations of the water in the girl's swimming-pool. This pool is used by fewer students and the water is filtered before entering the tank. It will be seen that the results show a very satisfactory condition of the water and indicate that the method of filtration yields a satisfactory degree of purification.

TABLE 5.—BACTERIOLOGIC EXAMINATIONS OF WATER FROM BOYS' SWIMMING-POOL AFTER ONE LITER OF URINE HAD BEEN ADDED

Sample	Date	Hour	Counts on Gelatin per c.c.	Count on Agar per c.c.	Gas in Dextrose Broth			B. Coli Present in		
					0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
Pipe	2/6/11	11 a.m.	425	17	—	—	+	—	—	+
Tank	2/7/11	11 a.m.	9,000	130	—	+	+	—	+	+
Tank	2/8/11	11 a.m.	45,000	1,770	—	+	+	—	+	+
Tank	2/9/11	11 a.m.	15,000	105	+	+	+	+	+	+
Tank	2/10/11	11 a.m.	9,000	47	+	+	+	+	+	+
Tank	2/11/11	11 a.m.	5,000	258	—	+	+	—	+	+

CHEMICAL ANALYSES

Sample	Date	Hour	N as Free NH_3	N as Alb. NH_3	N as NO_2	N as NO_3	Total	Chlorin in p. p. m.
Pipe	2/6/11	11 a.m.	0.070	0.230	0.002	0.05	0.352	2.1
Tank	2/7/11	11 a.m.	0.090	0.240	0.003	0.03	0.363	1.7
Tank	2/8/11	11 a.m.	0.120	0.180	0.009	0.04	0.349	3.0
Tank	2/9/11	11 a.m.	0.160	0.220	0.011	0.04	0.431	2.0
Tank	2/10/11	11 a.m.	0.190	0.160	0.012	0.03	0.392	3.2
Tank	2/11/11	11 a.m.	0.250	0.310	0.016	0.02	0.596	1.7

Table 5 shows the bacteriologic and chemical results after 1 liter of urine had been added to the water in the pool in order to determine whether or not any material increase in the nitrogen and chlorin content would be manifest in the daily analyses. The urine was added

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Monday afternoon, February 6, after a sample had been taken at the pipe. The maximum count on gelatin was relatively quite high and the counts remained high during the week. The agar counts were somewhat low, but *B. coli* was constantly present in 10 c.c., 1 c.c. and occa-

TABLE 6.—BACTERIOLOGIC EXAMINATION OF WATER FROM BOYS' SWIMMING-POOL, SHOWING REDUCTION OF BACTERIA CAUSED BY ADDITION OF BLEACHING POWDER

Sample	Date	Hour	Counts on Gelatin per c.c.	Count on Agar per c.c.	Gas in Dextrose Broth		B. Coli Present in	
					1 c.c.	10 c.c.	1 c.c.	10 c.c.
Pipe	3/28/10	11:00 a. m.	275	16	+	+	+	+
Tank	3/29/10	11:00 a. m.	445	480	+	+	+	+
Tank	3/29/10	3:30 p. m.	920	483	+	+	+	+
Tank	3/30/10	11:00 a. m.	5,630	680	+	+	+	+
Tank	3/30/10	3:30 p. m.	19,100	1,140	+	+	+	+
Tank	3/31/10	11:00 a. m.	24,000	1,190	—	+	—	+
Tank	3/31/10	3:30 p. m.	10,000	1,080	—	+	—	+
Tank	4/1/10	11:30 a. m.	1,700	696	—	+	—	+
Tank	4/1/10	3:30 p. m.	2,570	780	—	+	—	+
Tank	4/2/10	10:30 a. m.	2,800	560	+	+	+	+

SAME SAMPLES TREATED WITH 0.5 PART AND 1 PART AVAILABLE CHLORIN, RESPECTIVELY, FOR THIRTY MINUTES

Sample	Date	Count on Agar Per Cent.		Count on Gelatin Per Cent.		B. Coli Present in			
						0.5 part av. cl.		1 part av. cl.	
		0.5 part av. cl.	1 part av. cl.	0.5 part av. cl.	1 part av. cl.	1 c.c.	10 c.c.	1 c.c.	10 c.c.
Pipe	3/28/10	0	0	1	0	—	—	—	—
Tank	3/29/10	4	0	5	0	—	—	—	—
Tank	3/29/10	8	0	8	0	—	+	—	—
Tank	3/30/10	4	0	2	2	—	—	—	—
Tank	3/30/10	30	0	45	1	—	—	—	—
Tank	3/31/10	130	5	120	1	—	—	—	—
Tank	3/31/10	14	0	27	1	—	—	—	—
Tank	4/1/10	15	0	9	0	—	+	—	—
Tank	4/1/10	12	0	30	1	—	—	—	—
Tank	4/2/10	27	0	66	0	—	+	—	—

sionally in 0.1 c.c. Its continued appearance in 1 c.c. was significant in this series, because it was absent from 1 c.c. of the pool water in most of the experiments. There is no essential difference between the results of the

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TABLE 7.—BACTERIOLOGIC EXAMINATIONS OF MEN'S SWIMMING-POOL; HYPOCHLORITE OF LIME TO GIVE ONE PART OF AVAILABLE CHLORIN PER MILLION, ADDED AT NOON JAN. 26, 1912

Date.	Gelatin Count per c.c.	Agar Count per c.c.	Gas Production			B. Coli Present in		
			0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
1/23/12	9,200	870	—	+	+	—	—	+
1/23/12	14,000	1,225	—	+	+	—	—	+
1/24/12	4,050	640	—	+	+	—	+	+
1/24/12	6,750	575	—	+	+	—	—	+
1/25/12	770	450	—	+	+	—	+	+
1/25/12	1,600	475	—	+	+	—	—	+
1/26/12	540	380	—	+	+	—	—	+
1/26/12	595	583	—	—	+	—	—	+
1/26/12 *	290	332	—	—	—	—	—	—
1/27/12 forenoon *	7	14	—	—	—	—	—	—
1/27/12 afternoon *	20	11	+	—	—	—	—	—

* After this count chlorin was added.

TABLE 8.—BACTERIOLOGIC EXAMINATIONS OF MEN'S SWIMMING-POOL; HYPOCHLORITE OF LIME ADDED TO GIVE ONE PART AVAILABLE CHLORIN PER MILLION ON MORNING OF FEB. 19, 1912

Date	Gelatin Count per .cc.	Agar Count per c.c.	Gas Production			B. Coli Present in		
			0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
2/19/12	400	219	+	—	+	—	—	+
2/19/12	2	8	—	—	—	—	—	—
2/20/12	16	26	—	—	+	—	—	—
2/21/12	414	290	—	—	+	—	—	+
2/23/12	1,500	4,540	—	—	+	—	—	+
2/24/12	2,500	9,500	—	—	+	—	—	+

TABLE 9.—RESULTS WHEN HYPOCHLORITE OF LIME TO GIVE ONE PART AVAILABLE CHLORIN PER MILLION WAS ADDED ON MONDAY AND AGAIN ON THURSDAY

Date	Gelatin Count per c.c.	Agar Count per c.c.	Gas Production			B. Coli Present in		
			0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
2/26/12 *	605	320	—	—	—	—	—	—
2/27/12	30	1	—	—	—	—	—	—
2/27/12	1	1	—	—	—	—	—	—
2/28/12	42	1	—	—	—	—	—	—
2/29/12 †	10	3	—	+	—	—	+	—
3/1/12	30	2	—	—	+	—	—	—
3/2/12	100	27	—	—	+	—	—	+

* Sample taken before bleach was added.
† After this count bleach was again added.

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chemical analyses of this series and those shown in Table 2. In general, the chemical results showed that nitrogen determinations were more delicate than chlorin determinations as an index of the sanitary condition of the pools.

Experiments were carried out in the laboratory on the action of hypochlorite of lime in purifying the water in the swimming-tank. The first step necessary was the determination of that amount of available chlorin per million which would produce practically sterile water. Samples of water from the boys' swimming-pool containing 250 c.c. each were treated with hypochlorite of lime in the proportion of 0.5 part and 1 part of available

TABLE 10.—RESULT WHEN HYPOCHLORITE OF LIME IS ADDED IN SMALL PORTIONS DAILY UNTIL ONE PART AVAILABLE CHLORIN PER MILLION IS PRESENT FINALLY

Date	Gelatin Count per c.c.	Agar Count per c.c.	Gas Production			B. Coli Present in		
			0.1 c.c.	1 c.c.	10 c.c.	0.1 c.c.	1 c.c.	10 c.c.
3/4/12	6,000	2,765	—	—	+	—	—	+
3/5/12	7,000	3,900	—	—	+	—	—	+
3/5/12	12,000	3,060	—	—	—	—	—	—
3/6/12	50,000	12,000	—	+	+	—	+	+
3/6/12	67,500	2,510	—	—	—	—	—	—
3/7/12	27,500	4,650	—	—	—	—	—	—
3/8/12	20,000	15,000	—	—	+	—	—	+

chlorin per million for thirty minutes. The bacterial content of the samples was materially reduced and the colon bacillus generally destroyed with the use of 0.5 part of available chlorin. When 1 part of available chlorin per million was used the water became practically sterile and all traces of the colon bacillus disappeared. The results are shown in Table 6.

The next experiment consisted in putting the hypochlorite of lime into the swimming-tank and making a series of examinations. The results are given in Tables 7, 8, 9 and 10. These tables show that to obtain satisfactory results, the hypochlorite of lime must be added in sufficient quantities to give 1 part of available chlorin

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per million. They show further that when the tank is being used the effect lasts only about three days, after which there is considerable increase in the number of bacteria present. To obtain entirely satisfactory results under the conditions as they exist at Wisconsin, hypochlorite of lime in the proportion mentioned must be added to the swimming-pool twice each week.

Table 10 shows the results when the hypochlorite of lime is added daily in small amounts, reaching finally a maximum of 1 part of available chlorin per million. They are seen to be unsatisfactory.

CONCLUSION

It must be admitted that contagious diseases can be spread by means of artificial swimming-pools, and that if the water contains the germs of typhoid fever they can be taken into the system. With ordinary waters and with a pool of good capacity, the change once a week keeps the water in fairly good condition. The addition of hypochlorite of lime is a simple, cheap and safe procedure which insures absolute safety.

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OCCUPATIONAL EYE DISEASES AND ACCIDENTS

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A complete catalogue of the various trades and industries in which accidents, even preventable accidents, causing partial or complete blindness of one or both eyes, although suggestive, would be of little service and would necessarily include nearly all the causes of accidents in general. It will not be without profit, however, to consider those industrial accidents which are of frequent occurrence. Space forbids full consideration of the effects on the eyes of environment, lighting, improper or excessive use of the eyes, the special toxic effect of alcohol and tobacco, and special infections in the ordinary occupations.

COMMON, PREVENTABLE ACCIDENTS

I shall first discuss common accidents to the eye in foundries, machine-shops, mills, and in the building trades, domestic, agricultural and military pursuits, which can be greatly lessened by various known means, such as have been applied among iron workers, mechanics or weavers.

These accidents include blows from blunt force and wounds of all description — incised, punched, lacerated and contused—occurring from the use of tools or caused by foreign bodies of all kinds, magnetic or non-magnetic, retained or not within the eye. Ordinary domestic injuries, in addition to the above, include scratches of

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the conjunctiva or cornea and wounds from knives, scissors, forks, useless air-guns, fireworks, improperly carried umbrellas, etc.

Blows from blunt objects on the eye or its surroundings may cause ecchymosis and swelling of the lids, fracture of the orbit, ecchymosis and hematoma of the conjunctiva or orbit, rupture, concussion or dislocation of the eyeball, rupture or paralysis of the muscles, rupture of or pressure on the optic nerve by hematomas, aneurysms or fractured bones. In addition the iris may be torn, the lens dislocated and the various structures within the eye injured. The base of the skull may be fractured and traumatic exophthalmos result.

Small particles are likely to become lodged in the cornea of workmen of various trades, especially in the iron and steel trades. This is common in the eyes of grinders, especially dry grinders who do not use a wet stone, small particles of the metal being ground off the stone or emery-wheel used. Close examination, with a magnifying glass or loupe, of such workmen's corneas, often peculiarly insensitive, will usually show large numbers of minute scars, sometimes so numerous as to dull the cornea and affect the vision. Fans making air-currents so as to pull or blow the particles away from the eyes are important in many trades; the fans also prevent the inhalation of foreign particles or noxious gases, thus securing better ventilation and benefiting the general health. Various shield devices, solid and adjustable, are now on the market. They are used generally by the United States Steel Company and are exhibited in the American Museum of Safety in New York of which Dr. Tolman is in charge. These shields are placed on grinding-wheels, circular saws, lathes and many forms of rapidly revolving machinery, helping to prevent particles flying against the workman's face, and are a safeguard against accidents in case the revolving parts should break. Recently much has been done to prevent revolving wheels, etc., from breaking by the use of

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proper compressible washers, larger than the flanges, making proper application and distribution of pressure to a large space on the side of the straight-sided wheels. The flanges are more than half the diameter of the wheel and bear only at their circumference on a flat surface. The caliper-rest is adjusted as close to the wheel as possible, lessening the danger of the material being caught between the wheel and the rest. Large protecting glasses or the worker's own lenses, if he wears any, are also of much service in preventing particles getting into the eyes, as well as for saving the eyes from more dangerous accidents from large flying particles. Glass protectors are also made surrounded by wire gauze as in goggles. Unfortunately they get dirty and marked with the frequent blows from flying particles, so that the workmen, unwilling to accept such pressing testimony of their use, too often lay them aside.

Injuries from these small flying particles may be slight or serious. Sometimes small particles puncture the coats of the eyeball and unless removed, especially if metal, endanger both eyes by causing sympathetic inflammation, which according to Magnus is the cause of from 4 to 4.5 per cent. of total blindness. In some cases infection results, giving rise to dangerous ulcers which sometimes destroy partially or wholly the eyesight or even the eyeball. Serious accidents to other parts of a workman or even to other workmen sometimes occur, because an operator with a foreign body in his eye cannot see sufficiently to manage machinery. The opportunities for slight or severe eye injuries in iron and steel workers are multitudinous and occur in all branches of the work, light or heavy.

Many of these accidents occur in chipping, fettling or dressing rough edges of castings, ingots and even large armor-plates. These chippings are brittle and sharp and fly about, often bounding from objects which they strike. The accidents are caused by one or two strikers hitting a chisel held against the casting by another man.

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Particles are likely to fly not only from the metal struck but also from either end of the chisel or from the hammers of the strikers. S. C. Ayers has pointed out that cheap hammers and chisels of poor quality are frequent causes of eye accidents in mechanics. Care is taken in some shops to examine carefully and regularly these tools to prevent accidents. Pneumatic chippers are safer. Passersby and other workers may be protected by chipping against a wall or a screen covered with canvas or burlap which will hold the flying particles and not reflect them. Brick-cleaners should take similar precautions.

Burning sparks and flashes are commonly caused from molten metal running into molds, in great or small forgings, by hand, steam or hydraulic hammers. When there is great heat, glass protectors to the eyes are of little service, but good safe protectors of wire gauze covering both eyes and face, especially those with asbestos over mouth and neck, are useful. Rusting may be provided against by making the frames of galvanized iron or aluminum wire.

Coal-miners are likely to be injured by small particles of coal or splinters from the pick point becoming embedded in the cornea, abrading its surface or cutting it. Such wounds are particularly likely to become septic. Agriculturists often meet with eye accidents in threshing, chaff-cutting, hedging, in distributing artificial fertilizers and by the entrance into the eye of spears of grains and grasses, twigs and leaves, and from insects and their stings. These injuries are usually produced by vegetable substances, straw, beards of wheat, etc., and are likely to become infected. Cow-horns, claws and kicks from animals cause many accidents. In taking care of some plants special forms of affection result, as ophthalmia among hop-pickers due to entrance of fine, thin hair-like processes from the hop leaves. Dusty labor is liable to cause troublesome eye conditions as in sawmills from flying sawdust and knots, at threshings,

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in handling coal and ashes, in flour-mills and from fine particles of copper off trolley wires; but the eyes can be greatly protected by proper goggles.

Stone-masons, grindstone-makers, quarrymen, bricklayers and stone-breakers can partially protect their own eyes by proper protectors and should be more careful to dress their work against some wall where passersby will not be so likely to be injured. Wire-drawing, in which great tension is placed on the wire, causes accidents from breaking or slipping of the wire which backlashes and may strike some one. In weaving there is great danger of a flying shuttle striking the eye, but many patterns of guards are now on the market to prevent this. Some are known as wing guards, consisting of a wire screen or canvas placed between the looms; others provide means to prevent the shuttle from rising. The military man and sportsman are subjected to the danger of small and large shot and bullets, shell explosions, sword and bayonet injuries and explosions of various kinds.

There are various processes involving exposure to irritating dusts, as to the dust of graphite in the manufacture of stove polish, bronze powder, while bronzing in lithographing, in all processes of grinding, glazing or polishing, and while talc (soapstone) dusting in rubber manufacturing. In sorting, dusting, cutting or grinding rags, and in cutting, boring, turning, planing, facing, doming, grinding or polishing pearls or buttons, shell dust is also likely to get into the eyes. Everywhere in the air volcanic and meteoric dust is present, the latter consisting of tiny spherical shot-like pellets, from 1/200 to 1/500 of an inch in diameter. The flinty shells of diatoms, tiny plants, and dust from sandstones and deserts often get into the eyes. The pollen of plants as from pine-trees, scales from the wings of butterflies and other insects, and hairs as from caterpillars, also get into the eyes.

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ACCIDENTS FROM EXPLOSIVES

Accidents occur while high explosives are being handled, as in clay manufacturing, quarrying, mining and railroad construction.

Blasting in mining, quarrying, etc., causes a large number of accidental injuries. These accidents are particularly liable to destroy both eyes, removing the earning capacity of the individual and possibly throwing him on the community for support. Powder-grains are often embedded in the eyeballs, lids or face. Most high explosives, unlike gunpowder, are not exploded by simple ignition but require an exploder. Poor fuse or explosives, possibly frozen, with improper loading, cause premature blasts or misfires. Accidents usually occur from drilling these "missed holes," striking an unexploded piece of explosive, cap packing with a metal instead of a wooden tamping rod, carelessness with cigar ashes, hot candle grease or in handling the explosives. Donovan[1] states that blasting injuries with few exceptions result from want of care on the part of the patient, his associates or his predecessors at work. Large quantities of explosives, whether solids, liquids or gases, should not be stored in any one place, especially in thickly settled communities. Greater care in proper insulation of electric wiring in such regions and the prevention of the possibility of sparks by short-circuiting should be observed. Licensing of "powder men" and better government inspection of the manufacture, storage and sale of explosives would be helpful.

ACCIDENTS FROM FLYING GLASS

Accidents to the eyes occur from the bursting of locomotive oil- and water-gauges, and bottles and siphons in bottling.

Gauges on every description of steam boiler frequently break, injuring by flying pieces of glass, or scalding by the steam or hot water. The slowly soluble gauges are

1. Donovan, John A.: THE JOURNAL A. M. A., Aug. 5, 1905, p. 387.

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worn by the friction of the moving fluids within and may be protected with wire netting or plate-glass protectors open at the back, so that the direction of an explosion may be controlled. The chief danger comes when putting in a new glass after one is broken. On turning the hot water into the cool glass it suddenly breaks. The United States Steel Company has swinging wire protectors that may be placed in front of these gauges until the glass has been warmed and tried, when the protector is swung out of the way so that it can be more readily seen by the engineer at a distance. These accidents, occurring to engineers, who require a high degree of visual acuity, greatly lessen their earning capacity and at the time of the accident may endanger many lives and much valuable property.

In the manufacture of aerated waters and in bottling beverages of nearly all kinds, the frequent bursting of bottles and syphons is very dangerous to the eyes. The bottles are cleaned, filled, corked and wired by machinery and in all the various processes and inspections which are necessary, there is danger of the bottles bursting. The Dangerous Trades Committee of Great Britain, in 1896, recommended that all bottlers, wirers, sighters and laborers while at work should be provided with face-guards, masks or veils of wire gauze. They also recommended the providing of gauntlets for the arms and the fencing with wire gauze of all machines for bottling, to prevent fragments of bursting bottles striking any workers.

ACCIDENTS FROM SCALDS AND FUMES

Accidents somewhat similar to the preceding are caused by scalds or caustics or exposure to irritating gases and fumes as from hot fluids, molten metals, lime or corrosive acids or alkalies entering the eyesac.

Scalds or burns usually involve the eyelids; the deeper burns affecting the eye generally result from explosives as in preventable Fourth of July accidents. Powder-burns should be treated with hydrogen peroxid,

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and Würdemann then applies for from six to twelve hours 33⅓ per cent. papain in glycerin to digest the injured tissue, afterward applying 5 per cent. boric or other simple ointment. Powder-grains or other foreign bodies in the cornea require the use of a local anesthetic and spud. Burns in masons, plasterers and bricklayers caused by lime, especially unslaked lime, calcium oxid, sometimes result in destruction of the cornea and frequently in traumatic pterygia and adhesions between the eyelids and globe and, because of chemical combination with substances in the cornea, produce permanent opacities. When unslaked lime gets into the eye it should be wiped out by a dry clean cloth or washed out with liquid petrolatum or castor or olive oil. If this is not done at once the lime will soon be slaked by the tears and then large quantities of water can be used to help remove it. Besides causing actual destruction, lime and cement have irritating qualities, sometimes occasioning conjunctivitis and even ulceration of the cornea with loss of vision in those who work constantly with these substances. There are also various caustics employed, as in the manufacture of chemicals, alkalies and acids.

Proper, clearly worded signs, giving warning of the dangers from careless handling of caustics in shops and schools, would lead to greater care being exercised. In accidents caused by unslaked lime and certain corrosive fumes, workmen should pour olive or even castor oil (quantities of which should be kept handy in certain trades) into the eye. If oil is not quickly obtainable large quantities of water should be used. There are certain advantages in the use of water in that the inexperienced find it very difficult to manipulate the slippery lids after the first drop of oil has been used.

Ammonia burns should be treated immediately by profuse irrigations with water, according to Pichler.[2]

2. Pichler: Cauterization of the Eye and Epidermis by Ammonia, Ztschr. f. Augenh., 1910, xxiii, 297.

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For workmen compelled to use certain acids or alkalies proper neutralizing washes should be supplied so that fellow-workmen, properly instructed, may use them at once. After burns of the cornea by acids, Guillery[3] advises bathing the eyes with 0.5 per cent. solution of potassium hydrate, and says that the opacities from lime may be partially cleared by the use of a 10 per cent. solution of ammonium chlorate with 0.1 per cent. tartaric acid. For lime-burns Würdemann advises copious washings with cold water and the use of from 3 to 10 per cent. solution of ammonium chlorid, the calcium being dissolved and carried away. Any mildly acid solution may be used for recent burns with alkalies. Schmidt[4] asserts that corneal burns from acids are likely to cause opacities of the lens. Exposure to irritating gases and fumes takes place chiefly in gassing in textile factories, singeing in print works, bleaching and dyeing works and in dipping metals in acid solutions.

DISEASES FROM INTENSE LIGHT AND HEAT

Diseases resulting from excessive light or heat are not uncommon among electric welders, steel smelters and in those melting or annealing glass.

Metal-polishers and buffers, brightening surfaces which they must closely watch, often suffer with hyperesthesia of the retina. This can be relieved by proper lenses or colored glasses. Excessive heat and light are encountered in iron and steel works. Men can watch a furnace until the temperature reaches 2,000 F., but before it rises to 3,000 F., colored glasses should be worn. In working with cast iron, from 1,800 to 2,000 F., the men take few precautions; with molten metal, 2,700 to 2,800 F., deep blue glasses are necessary. With Bessemer metal, 3,000 to 3,200 F., the process is completed in about twenty minutes and only one man needs to watch the metal, which he does with a spectroscope

3. Guillery, H.: Chemical and Clinical Investigations on Cauterization of the Cornea, Arch. f. Augenh., lxv, 139.
4. Schmidt, H.: Ztschr. f. Augenh., 1910, xxiii, 241.

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about 30 feet distant. The Siemons process takes ten hours and all the men, wearing colored lenses, make observations frequently. If some of these hot furnaces are looked into without lenses it is several minutes before the eye can see ordinary objects again. Some men seem to have surprising immunity from bad results in dealing with these white-hot furnaces; others cannot endure them and must change their work. Snell doubts the greater frequency of cataract in glass-blowers and iron-workers than in others, although both are subjected to great heat and consequent loss of moisture. Herbert Parsons and Marcus Gunn in 1908 visited some of the important glass-works in England to gather statistics of industrial diseases for the framing of the workmen's compensation act. They state that bottle-makers have a characteristic form of cataract, typically, a dense, well-defined disk of opacity in the center of the posterior cortex. Often slight opacities surround this posterior cortical disk. Excessive heat and bright light are said to be the causes but the Germans claim that heat is the most important cause. Weyl mentions, besides glass-blowers, fire workers, puddlers, blacksmiths, bakers and cooks.

Great care is required to avoid very strong light flashes before the eyes, as in short circuits and electric welding. In the latter large shields are worn, in the center of which are four alternate layers of blue and red glass. Helmets and screens with four or six layers of red and green glass are often used. The temperature in electric welding goes as high as 7,000 F., but the question of whether it is the heat or the chemical rays that act so harmfully has not been settled. If the eyes catch the light they are affected at once, but chiefly some hours afterward. They feel swollen as if filled with burning sand and the pain is usually very severe; the lids are swollen and there is much lacrimation. Intense light as from electric and vapor lamps, from exposure to snow or after observing an eclipse, frequently causes a

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superficial ophthalmia and may affect the lens and retina.

Schanz and Stockhausen found that the superficial irritation could be prevented by a screen of euphos glass which absorbs ultraviolet rays. McMullen[5] states that this could be done with plain glass which absorbs rays of wave-length less than 300 microns. He thinks that opacities in the lens result when the wave-lengths are between 300 or 400 microns, but that the rays of greater length, as well as the short waves, cause the retinal changes. Würdemann says that electric light flashes or lightning may cause cataract and by being focused on the macula destroy the central retinal elements.

DISEASES CAUSED BY POISONOUS SUBSTANCES

Diseases result from working in certain poisonous gases and fumes, dusts or substances, bisulphids of carbon, lead, etc.

Dinitrobenzol is largely employed in making explosives. During the various processes of its manufacture fumes are given off which affect vision. These can be lessened by properly covering the mixtures and by the use of fans and exhaust apparatus. Respirators and glasses are used. The general circulatory and nervous effects are described by Snell,[6] who gives many excellent suggestions for preventing deleterious effects in manufacturing this substance. Carbon bisulphid, formerly much used in vulcanizing rubber, caused impaired eyesight, but this process has been so greatly modified that it is now of little importance in causing ocular lesions. Toxic amblyopias caused by tobacco, ethyl alcohol and wood alcohol are too well known to require consideration.

The eye affections formerly attending the manufacture of iodoform have by care been eliminated. A few cases of eye involvement have been reported in dye factories from handling the various coal-tar preparations. Arsenic from wall-paper, artificial flowers and Paris green, paper

5. McMullen, W. H.: Ophth. Rev., April, 1910.
6. Snell: Brit. Med. Jour., 1892, i.

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hangings and paintings, also when used for medical or cosmetic purposes, according to Casey Wood, has caused various visual disturbances. Painters, plumbers, electrotypers, file-cutters and many others through handling lead are likely to get chronic lead-poisoning causing central peripheral affections of sight, various paralyses, retrobulbar neuritis, etc. Lead-poisoning is also found among those manufacturing white, yellow, orange and red lead, lead pipe, solder and plumbers' supplies and in cutting metal articles composed of lead or lead and tin; in grinding lead paint, making storage batteries, cleaning or handling printing type and in glazing in pottery establishments. Poisonous gases and fumes are found in shoe cement, japanned or patent leather and rubber manufacturing, in which the mixtures containing naphtha are sometimes allowed to remain in uncovered containers and proper ventilation is not insisted on. Poisonous gases are also formed in certain lead processes.

DISEASES DUE TO PECULIAR OR PROLONGED USE OF THE EYE

Nystagmus in miners is an instance of the diseases found in workers following occupations requiring prolonged and peculiar use of the eyes.

Nystagmus in miners, due to their peculiar way of looking at their work, is fully described by Snell, who says that treatment consists in changing the kind of work. After relief the miner can return to his work if the head can be kept straight and the eyes are not often turned upward. Snell mentions several other occupations which he has thought might cause nystagmus because the eyes were turned directly or obliquely upward.

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OCCUPATIONAL SKIN DISEASES

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With the exception of certain well-defined types, occupation dermatoses as a class have not, in this country at least, received the attention they merit. While every dermatologic clinic numbers among its applicants each year many patients in whom occupation has a direct or indirect bearing on the causation of their eruption, it is difficult, owing to lack of systematic investigation, to give a definite idea as to the prevalence of skin affections in the various trades. At my own clinic at the University and Bellevue Hospital Medical College about 2 per cent. of the total number of new cases for 1911 constituted occupation dermatoses. The great majority of these were of the type known as trade eczemas, and while many cases yield readily to treatment and proper preventive measures, others constitute a serious inconvenience from an economic point of view, sometimes necessitating a complete cessation from work or a change of occupation.

Cutaneous vulnerability is more or less an individual peculiarity, for while there are persons who are so sensitive to an irritant — physical, chemical, thermal or actinic — that they react after a short exposure or contact by an acute dermatitis, others remain entirely unaffected. Occasionally such persons exhibit so high a degree of sensitiveness that instead of their acquiring an immunity, an increasing susceptibility is established. Fortunately these cases are not very common, and workers who are subjected to continuous injury usually

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do not develop lesions until after a longer time, either from the summation effects of the irritant or because the resistance of the skin has been gradually undermined.

After such a cutaneous outbreak there is frequently a tendency to acute exacerbations at regular intervals or when the occupation is resumed. These eruptions may then persist for years. While the skin both anatomically and physiologically is endowed with a relative amount of protection against the action of irritant substances, by reason of its exposure it is subjected to injuries of every description and these may lay the foundation for a subsequent eruption. In addition, there are other contributing factors, such as a "special susceptibility," a delicate skin or one presenting some congenital anomaly, as excessive dryness or ichthyosis, impaired gastro-intestinal, hepatic or renal function, a depressed state of health, neglected hygiene of the skin, or its lowered resistance because of a preexisting eruption.

The same etiologic factor is often found operative in both allied and unrelated trades owing to similar conditions under which the work is done; when, for example, men or women are exposed to excessively dry or moist heat. Such an atmosphere leads to congestion and interference with the normal activity of the skin which is followed by various inflammatory processes and sweat-eruptions like prickly heat. These affections are seen in cooks, stokers, firemen, foundry-workers, etc. A warm, moist medium such as laundresses work in sometimes produces a cystic condition of the sweat-ducts of the middle third of the face, known as hydrocystoma. Cold, by favoring the development of chilblains, causes much suffering among persons who are obliged to carry on their work outdoors or in poorly heated places. In factories in which drastic measures are employed for the removal of dirt or stains, cleansing agents like chlorinated lime (chlorid of lime) or benzin used on the hands supplies the base for an eczema by divesting the skin of its natural secretions. Oil, which is used

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wherever machinery is installed, is the causative agent of acneiform and eczematous lesions in employees who operate or are otherwise engaged about such apparatus. In occupations which necessitate standing, persons who have a tendency to varicose veins not infrequently exhibit this condition with a secondary eczema and ulceration. Slight traumatisms lead to erosions of the skin which often become infected in patients who, owing to the venous congestion, have slight resistance. Young women who are obliged to stand at their work sometimes develop erythema induratum or Bazin's disease, which is characterized by nodules beneath the skin which may break down and produce ulcers. Some of these forms of Bazin's disease have been proved to be tuberculous. The infection is usually of benign type and readily yields to rest in bed, improved nutrition and a change to better hygienic surroundings (Fig. 1).

Many occupations bring about changes in the skin which are not pathologic in the strict sense of the word but are so characteristic for certain occupations that Blaschko has given these changes the name of "trade stigmata." These include localized thickenings of the horny layer in shoemakers, tailors, musicians, etc.; bronzing of the skin in gardeners, farmers and other persons who follow outdoor occupations; staining of the hands of dyers, chimney sweeps, etc.; pigmentation in workers in silver from a deposit of the metal and in millers from iron particles, etc.

The skin may respond to the most diverse irritants by the production of a catarrhal inflammation, or may develop different types of eruption from the action of the same agent. An example of the former may be found in the trade eczemas and of the latter in the effects of tar, which may cause eczema, acne, warty and epitheliomatous lesions, alone or intermingled.

The commonest type of occupation disease is an eczematoid dermatitis. In a recent article Herxheimer[1]

1. Herxheimer, Karl: Ueber die gewerblichen Erkrankungen der Haut, Deutsch. med. Wchnschr., Jan. 4, 1912.

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enumerates seventy-four trades provocative of this form of disease. It may vary in grade and intensity from an erythematous and scaling dermatitis to a vesicular and bullous eruption. As the condition becomes chronic, infiltration of the skin takes place with desquamation and fissuring. With the cutaneous defenses lowered, pus infection is frequently superadded.

The excessive use of soap and water reduces the resistance of the skin by extracting the fat and macerating the horny cells. They may then act as direct excitants or prepare the way for some other irritant, as washing powders, etc. Severe eczemas of the hands and forearms are seen in those whose occupation requires them to have their hands continually in water, as in the case of washerwomen, housemaids, barkeepers, etc. In my clinic nearly one-third of the occupation diseases during the past year were seen in persons whose vocations necessitated the frequent employment of soap and water and, in some cases, the various cleansing alkalis.

In bakers a form of dermatitis of the hands and forearms is known as baker's itch. The exciting causes are the heat, the moist dough and saccharin solutions. A mite said to live in flour has also been incriminated. Candy-makers suffer from a similar eruption as well as from impetiginous lesions. Confectioners, bakers and preservers of fruit frequently show an eczema of the fingers and peri-ungual tissues from the action of fruit acids.

Winfield[2] describes a dermatitis in sugar-refiners which involves the hands, forearms and legs and resembles an impetiginous scabies. It has been asserted that a mite found in raw sugar is responsible, but this lacks verification. Oliver[3] says that in sugar factories a condition known as "lymphangitis of sugar-makers" is sometimes found among the sugar-refiners and molasses-stirrers. It is accompanied by a slight constitutional

2. Personal communication.
3. Oliver, Thomas: Diseases of Occupation, E. P. Dutton & Co., 1908.

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disturbance, and a crop of boils is not an unusual sequel. According to Gaillot the lymphangitis is an infection caused by the *Staphylococcus pyogenes aureus*. This organism is said to be found not in the freshly made molasses but in the residue; the temperature of the factory and the condition of the skin of the workers favor its development.

Builders and masons develop an eczematous affection of the exposed parts of the body from the irritating effects of lime and cement. In stone-cutters an analogous condition is caused by the stone dust. A palmar dermatitis is also seen in brickmakers.

Metal workers, from the constant irritation of the dust or filings, or from the direct cauterant action of these or the acids or turpentine used in the various processes, suffer from all grades of inflammation to intractable ulceration.

Printers and machinists, from contact with chemicals and oil, often develop a chronic eczema of hands and forearms. Electroplaters are also liable to an inflammation of the hands and forearms from the use of a mixture of lime dust and olive oil in "finishing," and from sour beer in the process known as "scratch brushing."

Workers who handle the chromates in the arts and trades suffer from an eczematous eruption as well as from ulceration of the skin and mucous membrane which shows little tendency to heal.

Hydrofluoric acid, employed in the manufacture of glass, the bleaching of cane, washing of manure, etc., produces sores of the nasal orifice and gums and painful blisters and ulcers of the skin.

The irritant action of arsenic on the skin is well known. In the arts and manufactures in which its compounds are employed workers are attacked with eczema or ulcerative or gangrenous lesions, which may be present on the face, neck and extremities, but more especially on the genitals. In color-works, ulcers of the hands are designated "arsenic pock." Arsenic sulphid

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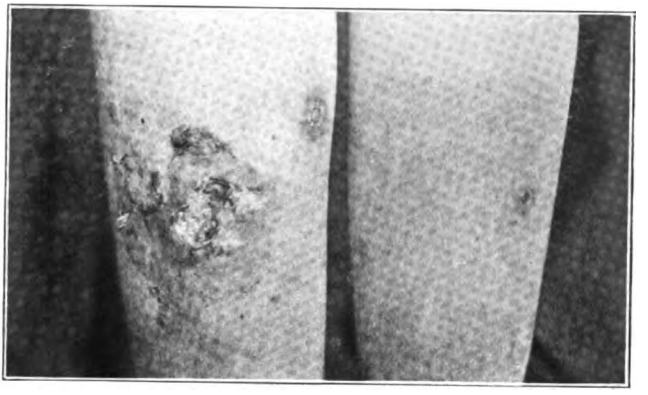

Fig. 1.—Erythema induratum (Bazin's disease).

Fig. 2.—Chronic eczema of the hand in a furrier.

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which, with lime, is used in curing fur, sets up a very severe dermatitis in furriers, not infrequently with persistent ulceration (Fig. 2).

Chemists are prone to inflammation of the hands and sometimes of the face from handling various drugs and chemicals. Their skin often develops so marked a susceptibility that minute quantities or even fumes will call forth an outbreak. I have several times noted a similar anaphylactic condition from formaldehyd solution in laboratory workers. Another familiar example of an eczema caused by chemical action is eczema of the hands of physicians and nurses from the use of antiseptics, notably mercuric chlorid and phenol (carbolic acid). These forms of dermatitis are very rebellious to treatment.

Among miners, smelters and photographers an eruption of erythematous and pustular type is sometimes encountered from the irritant effects of mercury. Photographers are also subject to an eczema, more especially of the terminal phalanges and nails, from other reducing agents, particularly pyrogallic acid.

In hat factories eczema of the hands is said to result from the manipulation of hot water acidulated with sulphuric acid.

The eczema in tobacco-workers is believed to be caused by the caustic solutions used in separating the tobacco leaves.

Calico-printers suffer from eczema, fissures and wounds which often become infected. The cause is attributed to the bleaching and cauterizing substances handled.

In flax-workers and linen-workers various skin affections are reported, among them a follicular eruption caused by the oils and irritating materials used in this occupation. In Belgium many of the flax-workers show a peculiar abrasion and ulceration of the palmar surface of the hands. Fissures form, exfoliation takes place and when the deeper structures are involved the condition simulates a syphilitic lesion. An eruption resembling

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small-pox has also been described on the forearm, arm and face of workers who remove the bobbins from the spinning-frames. From the pressure and friction caused by pulling threads the persons who engage in this part of the work present callosities on their index-fingers.

Callosities of the palms are also seen in laborers, engine-runners, etc. Among miners they form a special dermatosis called "beat hand." Painful thickenings develop over the regions where the handle of the pick makes greatest pressure, along the bases of the fingers, and over the ball of the thumb and outer side of the hand. The subjacent tissue becomes inflamed, and not infrequently is further complicated by suppuration. To this condition the term "keens" is applied.

Warts sometimes form troublesome lesions on the palms of persons engaged in manual work. In some cases they are purely epidermic growths; in others in which the epidermis has been removed, the underlying tissue as the result of irritation becomes the seat of exuberant granulations with papillomatous formation.

Dyers and workers in anilin colors are apt to develop eczematoid and pustular eruptions on different portions of the body. The bad effects are not limited to those in this trade, but the wearers of clothing prepared with certain of the dyes may ultimately be the victims of a severe dermatitis. The black, red and orange-yellow pigments are particularly irritating, marked inflammatory reactions having been caused by socks, gloves, underwear and shoes so colored. I have also seen unusually severe forms of eczematoid dermatitis in barbers who had employed proprietary anilin hair-dyes on their patrons (Fig. 3). It is not an uncommon experience in dermatologic practice to be consulted for a dermatitis of the face, neck and ears which had followed the application of some of these hair-dyes. In susceptible subjects the use of hair-tonics may produce similar trouble. Another dermatologic condition common in anilin workers is hyperhidrosis of the palms caused by washing

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the hands with chlorinated lime for the removal of the dyes. According to Blaschko,[4] it may be so intense as to amount to a flux. The affection is also seen among employees in chlorinated lime and soda works.

The manufacture of calcium chlorid and sodium and potassium chlorid by electrolysis is sometimes attended by an erythematous and edematous inflammation of the face of the workmen, resembling erysipelas. This is attributed to the sodium hypochlorite that is formed. With the subsidence of the acute process an acneiform eruption is left behind, the so-called chloracne. This is the commoner cutaneous malady seen in this occupation and is characterized by the early development of blackheads on the face, trunk and extremities followed by a grayish discoloration of the face. Inflammation and suppuration of the follicular glands is not uncommonly followed by nodules, pustules, boils and disfiguring scars.

Tar-workers and paraffin-workers develop a similar eruption which may last several months and then change to the so-called "tar itch." This is accompanied by hyperkeratosis and increased activity of the sebaceous glands, forming plaques and crusts, with the further development of multiple warts, one or more of which degenerate into malignant growths. The disease affects chiefly the hands, forearms and scrotum. It progresses slowly and in many instances no recurrence takes place after removal of the epithelioma. Oliver cites the case of a man aged 58, who had worked among coal-oil and tar products for thirty-years. He presented numerous indurated patches, some of which had ulcerated, as well as multiple black warts and scars, the remains of old ulcers. His son, aged 27, following the same employment, developed a malignant growth of the forearm which necessitated amputation. Metastases of the axillary and cervical lymph-nodes took place and the patient succumbed to secondary carcinosis.

4. Blaschko, A.: Gewerbliche Hautkrankheiten. Handbuch der Arbeiterkrankheiten, T. Weyl and Gustav Fischer, 1908.

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Cancer in chimney-sweeps has been reported chiefly from England. The soot produces a chronic irritation of the skin and when retained in such regions as the folds of the scrotum causes warty growths which become epitheliomatous. In some instances the hands, arms and thighs have been involved. With the advent of machinery for cleaning chimneys the incidence of scrotal cancer has been markedly reduced. It is reported that gardeners who employ soot for the protection of plants from slugs in a like manner show the effects of this irritant in the development of malignant growths of the hands.

Gardeners and florists frequently suffer from some form of inflammation of the hands and arms occasioned by contact with certain plants. It is estimated that between sixty and seventy plants possess this irritant action and the power to induce a dermatitis. The more familiar ones are poison ivy, poison sumac, primrose, chrysanthemum and eucalyptus, the eruption varying from a simple erythema to marked swelling with the formation of vesicles and bullæ. Not only are the exposed parts involved but the affection may be carried by the hands or clothing to other portions of the body. It is probable, as in the case of *Rhus toxicodendron,* that the active principle in the majority of these plants is an essential oil. Lacquer,[5] which is obtained from a tree belonging to the genus *Rhus,* produces a dermatitis either by direct contact or through the fumes by evaporation. The symptoms, consisting of fever and edema of the skin of the face, limbs and generative organs, nasal and conjunctival catarrh, and a papular eruption of the legs and forearms, appear in a few hours.

The resinous dust of certain hard woods, like teak, ebony, satinwood, rosewood and others, will occasionally set up a dermatitis in carpenters and joiners. In teak, the exciting agent is believed to be an essential oil derived from the central part of the tree and present in the dust. The symptoms are sometimes very severe, the

5. Castellani and Chambers: Lacquer Poisoning, Manual of Tropical Medicine, 1910, p. 118.

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eruption becoming generalized and accompanied by vomiting. It may last for several months and is quite apt to recur when the patient resumes work.

The so-called polisher's itch of the forearms and hands, found in furniture-polishers, is attributed to the methyl or impure alcohol present in varnishes and polishes. Impure turpentine and benzin used for cleansing purposes likewise provoke an eczema of the hands.

In persons who follow an outdoor occupation the uncovered portions of the skin sometimes undergo peculiar degenerative changes. Under the name of "sailor's skin," Unna has described an affection which he observed chiefly in seafaring men. A diffuse cyanotic redness, not unlike chilblain, develops at first on the ears, adjacent parts of the cheeks and temples, the backs of the hands and fingers. The skin then becomes mottled, pigmented, rough and hard and in places papillomatous. These warts may last for years and slowly undergo a malignant change. A similar condition is seen on the face, neck and hands of people who follow agricultural pursuits. The cause is sought in the actinic rays. The effect of light on the skin is illustrated in *x*-ray workers, in whom, unless protected, the hands become the seat of a mild erythematous squamous eruption, more or less persistent, which is succeeded by pigmentation, telangiectases and atrophic wrinkling. This condition may remain unchanged or keratoses may be added which develop into epitheliomas.

Drivers and coachmen exposed to the rigors of the weather are often the subjects of the severer forms of rosacea. The use of alcohol, however, to which many of these people are addicted, cannot be wholly ignored as a contributing etiologic factor.

Certain callings, notably those dealing with dead or live animals or their products, favor the development of infectious diseases. Owing to the prevalence of pyogenic organisms, local pus infections, as boils, carbuncles, impetigo contagiosa or cellulitis are not infrequently

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encountered in butchers, slaughter-house men and other individuals who handle dead animal matter. A generalized bullous dermatitis with severe constitutional symptoms and a high mortality has also been observed. The starting point is usually an infected wound. Several years ago Bowen[6] pointed to a possible relationship between these cases of so-called acute infectious pemphigus and foot-and-mouth disease of cattle, as he had observed such instances during an epizoötic of the latter disease in New England. Foot-and-mouth disease takes place by inoculation of the skin or mucous membrane in butchers, dairymen, stable boys and drivers. Herxheimer records having seen a case in a horse-dealer.

The parasitic diseases which are more definitely identified with particular avocations are tuberculosis, anthrax, glanders and actinomycosis.

Inoculation tuberculosis occurs in its simplest form as verruca necrogenica, or anatomic tubercle. It is encountered chiefly among medical students, physicians, hospital ward attendants, and butchers as a localized papillomatous formation usually about the knuckles or other parts of the hand or forearm.

Anthrax is uncommon in this country, but it is prevalent in animals in certain parts of Europe and Asia, especially cattle and sheep. In man the disease occurs as the result of direct infection from such animals or their products via the skin, the intestines or more rarely the lungs. It is seen in the wool-sorting, wool-combing and spinning industries, horse-hair and brush factories, in stevedores, wharf-laborers, carters, farmers, shepherds, butchers, meat inspectors and cattle salesmen. The internal form is known as wool-sorter's disease. Of the external, which is also the more usual, there are two varieties, the malignant pustule and malignant anthrax edema, which is the more fatal of the two.

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6. Bowen, J. T.: Acute Infectious Pemphigus in a Butcher During an Epizoötic of Foot-and-Mouth Disease with a Consideration of the Possible Relationship of the Two Affections, Jour. Cutan. Dis., 1904, xxii, 253.

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Glanders, usually contracted from horses, is seen almost exclusively in hostlers or those who have to do with these animals. It is rare in this country. The bacillus may gain entrance through the mucous membrane of the eye, nose, mouth or respiratory tract, or the site of inoculation may be a lesion of the skin. Clinically the disease is divided into glanders and farcy, according to whether the lesions of the mucous membrane or skin predominate. Both types present an acute and a chronic form.

Actinomycosis is endemic in cattle and more rarely affects horses, hogs and other animals. In man the disease is seen in those who come in contact with such animals or handle fodder or grain, as farmers, coachmen, dairymen, millers, etc. Infection in man takes place through a carious tooth or lesion in the mouth and less often through the skin. The ray fungus is believed to flourish on corn, hay and cereal grains, as the latter have frequently formed the nucleus of an actinomycotic lesion.

Erysipeloid, an infection of the skin caused by poisoning from meats, fish, poultry, cheese and similar animal products, is seen chiefly in butchers, fishmongers, poultry-dealers, cooks, and scullions. Gilchrist[7] observes that crab bites and injury by crabs are a frequent cause. The disease is believed by Rosenbach to be caused by a microorganism of the order *Cladothrix*. It is characterizeed by one or more areas of slowly spreading inflammation, clearing up at the part originally affected and progressing slowly to new areas, the advancing border being festooned or scalloped. Burning, pricking or itching sensations accompany the affection, which involves chiefly the fingers and hands.

Among the minor infections may be mentioned ringworm transmitted from horses, dogs and other domestic animals to men and boys employed about stables or engaged in the care of such diseased animals. Ringworm

7. Gilchrist, T. C.: Erysipeloid, with a Record of 329 Cases, of Which 323 Were Caused by Crab-Bites or Lesions Produced by Crabs, Jour. Cutan. Dis., 1904, xxii, 507.

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of equine origin is characterized by the formation of irregular and projecting nodular lesions studded with pustules involving the beard region, neck, wrist or hands.

In certain grain regions infested by a mite, *Pediculoides ventricosus,* an intensely itching urticarious eruption is endemic among the farmers and laborers who handle sacks of wheat, barley and other grains or straw harboring this parasite. Small epidemics have also appeared at different times from the use of mattresses made from straw which the organism has made its habitat. To Dr. Jay F. Schamberg[8] belongs the credit of priority in describing the affection in this country.

In conclusion, while many of the industrial dermatoses lead to little inconvenience, some forms of dermatitis may become so severe that they absolutely prevent a man from carrying on his occupation. In certain susceptible individuals the action of the irritant is confined not only to the parts exposed but may spread over the entire body. Patients who develop such an idiosyncrasy should be guarded against these forms of dermatitis becoming permanent and advised to use the best means of prevention. Such measures cannot be discussed at length in a paper of this scope as they must necessarily fit individual cases. If the nature of the work permits, the wearing of masks and gloves to protect the exposed parts, as practiced by Chinese lacquerers, is advisable, but obviously this is not feasible in all forms of occupation. The use of soap and water is to be recommended in some trades in order to remove the noxious substances, while in those instances in which they prove to be the irritants they are positively injurious and should be sparingly used. In any case, after washing, the hands should always be carefully dried and if practicable covered with a protective ointment, or a salve or cold cream should be thoroughly rubbed into the skin at night. Persons whose vocations bring them in contact

8. Schamberg, Jay F.: Grain Itch (Acarodermatitis Urticarioides): A Study of a New Disease in This Country, Jour. Cutan. Dis., 1910, xxviii, 67.

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with live or dead animals or their products should be instructed as to the mode of inoculation of infections from these sources, and all wounds or breaks in the continuity of the skin should be sealed with collodion, plaster or other protective dressing.

8 West Seventy-Seventh Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. STEVENSON AND FORDYCE

DR. CHARLES F. STOKES, Surgeon General, U. S. Navy, Washington, D. C.: Our activities in the Navy along the line of occupational hygiene are undertaken entirely to add to military efficiency, our humanitarian interest being subordinated and secondary. General sanitation has reached a very satisfactory plane. We have, however, grouped together in a battle-ship a more varied lot of activities, I think, than will be found elsewhere in the same space. There are disabilities attributable to the use of the searchlight, which is illuminated by an arc-light, inducing a coagulation in the retinal cells or changes in optic nerves. We aim to avert these disabilities by the use of electrician's glass to cut down the intensity of the light, and the use of Hallauer glass to diminish the deleterious effect of the actinic rays. In the turrets the gun-pointer adjusts or refines the pointing of his gun by means of a telescopic sight. We are studying the effects of these telescopic sights on the eyes, and are taking steps to avert disability from this cause. There is a menace in the double bottoms of battle-ships which has to be taken into account. I know of an instance in which two men lost their lives while inspecting double bottoms in a foreign navy. A study of the conditions there has led us to believe that they are not due to toxic gases, but rather to a diminished amount of oxygen. During battle practice we find that there are conditions in turrets which will have to be remedied; otherwise our men will not be so effective as they should be. We find that humidity runs rapidly up to saturation; that the normal carbon dioxid content of the air runs up to a dangerous point, and we find as well powder-gas contaminations in these situations. Steps are being taken to avoid these conditions. Our activities in some of these situations have gone so far that they are looked on as a great military asset, and as such are to be regarded as military secrets. We have been studying the atmospheric conditions in submarines with the hope of being able to sustain life beyond the time it is now possible to do so in the case of disabled submarines. The problem here is not so simple as it would appear at first thought. It is something more than the generation of oxygen. It means the destruction of carbon

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dioxid; the taking up of humidity and the doing away with battery generations, principally hydrogen and sulphuric acid, and carbon monoxid from back-firing of gasoline. We have been making systematic and careful observations in the fire-rooms of our battle-ships, studying the personnel and the chemical atmospheric conditions before, during and after endurance runs. We believe that some of the cases of heat exhaustion, or heat prostration, are due to some extent to a gaseous contamination, possibly carbon monoxid.

DR. WALTON FOREST DUTTON, Carnegie, Pa.: An occupational disease not very well known is vanadiumism. There are only about two reduction plants in the United States; and in those plants the frequency of the disease has run very high. The disease will become more prevalent as vanadium products become more generally used. They are being used more and more every day, especially in the manufacture of steel, in photography and in cloth manufacturing plants where mordants are used. The pentoxid is used in photography quite a great deal; vanadium chlorid and peroxid are used as mordants in printing fabrics; the peroxid is used in the manufacture of steel. The greatest number of cases of vanadiumism are found in the reduction plants, especially in the men on the mixing floor and in those that work about the crucibles. This disease is not well known at the present time; but it will become more familiar to physicians as the use of vanadium products increases. An article that appeared in THE JOURNAL, June 3, 1911, p. 1648, will probably give a better description of the poison.

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RECENT HYGIENIC IMPROVEMENTS IN DAIRYING

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The production of clean milk has engaged the attention of business men for only about a score of years, and while all recognize the necessity of great reforms in the production and handling of this substance, the means of accomplishing this desideratum on a large scale have hitherto seemed practically impossible, except at a cost to the consumer which has proved excessive to all but the well-to-do. So many factors have had to be taken into account in the solution of this problem, that some of them up to this time either have been overlooked or have proved insurmountable. The main factor has only recently begun to receive its due weight in sizing up the situation, and this factor is, as will be shown later on, the dairyman himself—not the man who sells the milk, but the man who produces it and packs it off to market.

High-grade milk has for some years been brought to market from a relatively few high-grade and expensive dairies. Some of this is called "certified" milk, and is produced under the most favorable possible conditions, and is sold for from 15 to 22 cents a quart; which, of course, is a high price for a poor man to pay. So steps must be taken to produce a clean, safe milk which a poor man can afford to buy. Of all the milk brought to market, not over 5 per cent. can be "certified" while something must be done to make the remaining 95 per cent. at least safe for the millions of poor babies whose main, or sole, food-supply is cow's milk.

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Years ago a friend of mine started a dairy farm in which he employed many new and expensive devices to render the milk as nearly perfect as milk can be made. He employed maids, dressed like trained nurses, in clean starched caps and immaculate wash dresses, to do the milking, because he rightly maintained that women are gentler, neater and more dexterous at such work as milking than men, and that inasmuch as the moral treatment of the cow has an enormously important effect on the quality and wholesomeness of her milk, women, with their gentler and neater ways and more correct personal habits, are much better fitted than men of the same walk in life to milk cows and take care of the milk.

He also invented a covered pail with a small opening in the cover and a diaphragm consisting of a cloth stretched over the opening, to be milked through. Everybody was astonished at the great amount of dirt which collected on this sterilized cloth with each milking, no matter how many precautions had been taken in washing the milker's hands and the cow's flanks and teats. Great progress was made in producing clean milk and the new barns, with their fancy fittings and concrete floors and bright airy stalls, were so crowded that some of the cows had to be kept and milked in one or two old dusty, ramshackle barns. To the surprise of everybody concerned, the milk drawn in the old dusty barns was found to be nearly as clean and free from bacteria as that milked in the new up-to-date barns.

You may ask how it was known so promptly that the milk from the old barns was so nearly equal to that produced in the new barns. It was simply because the milk from every barn on the farm was carefully examined every day under the microscope and the bacteria counted. This similarity in the milks produced under such diverse conditions was evidently due to the covered pail.[1]

1. The pail now in use does not have a cloth diaphragm, as it has been found that a hood of metal over the small hole in the cover of the pail so arranged that the milker must direct the streams of milk from the cow's teats horizontally, instead of perpendicularly, answers practically every purpose. In other words, the contamination of the milk is caused by the dust which falls into the pail from the cow's sides, the milker's hands and clothes, and the dust that is always circulating in the air, especially of a stable.

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The fact that clean milk could by any means be produced in a dirty barn was a great discovery and bound to bring about radical changes in the entire dairy business. Like many of the most important discoveries and inventions in the world, it came about largely through an accident. Yet it is none the less valuable for all that, inasmuch as it bids fair to prove an inestimable boon to suffering humanity.

The dairy farm of which I have just spoken failed financially, partly because it was started some years ago, before the public was so wide awake as it is now to the question of clean milk, and partly because the whole process of producing clean milk was then much more of an experiment than it is now.

The man who started the dairy sold his interest in it after some years of struggle to make the public appreciate what he was offering them. He made no money by his venture, but he came out of it with the idea firmly impressed on his mind that clean milk for the multitude can be produced and sold at a price within the reach of any man of moderate means, always provided that the farmer can be induced to cooperate with the milk company or the wholesaler who puts the milk on the market.

I went with my scientific friend a number of times to a filthy and badly kept dairy and spent some hours of valuable time trying to impress on the dairyman how easy it would be to produce clean milk by a few simple precautions. Patiently and carefully the doctor (for the scientific dairyman was primarily a doctor and a hygienist) would state and restate the steps to be taken and his listener would promise in a half-hearted way to carry out the directions, but would invariably wind up the discussion by asserting that he ought to get at least a half cent more a quart for his milk. And so far as the farmer is concerned, this is the crux of the whole matter. If he is to produce cleaner and better milk, he must have some reward for his extra

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pains and trouble and the higher degree of intelligence which he puts into his business. The philanthropic attitude of those great milk companies which undertake to produce better and safer milk for the suffering and helpless babies of the tenements, and to pocket all of the advanced price themselves, has not seemed to appeal to the farmer. The farmer has had a hard enough time to make both ends meet without spending more money in producing wholesome milk than he can get for it. As one of them has expressed himself, he feels sorry for the poor sick babies in New York City, but the babies he is most interested in and is bound to take care of are his own babies. Consequently, if he should send better milk to market, he should demand a better price for it.

One of the great milk companies has had a long and expensive litigation because the farmers from whom they purchased the milk which the company sold, would not consent to have their herds tuberculin-tested. The idea of offering any more money to the farmers for their extra expense and trouble in getting their herds tuberculin-tested, never seems to have occurred to this company. Now that the suit has gone against it, however, the company seems to have been able to make some arrangement with the farmers, inasmuch as it announces that it is prepared to furnish tuberculin-tested milk at 10 cents a quart to anyone who wants it.

Now, in spite of every precaution that may be observed in drawing, handling and transporting milk, there is no absolute guarantee that it may not become contaminated with germs pathogenic to man.

The epidemic of tonsillitis and influenza which prevailed in and about Boston last spring and summer, and claimed many victims, of whom a considerable proportion died, was, after a careful and impartial investigation, traced to the milk from one of the best and most scientifically conducted dairies in the world. It was also found that the contamination of the milk

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was not due to any fault or carelessness on the part of any employee or agent of that dairy. So far as one can judge from a review of the testimony of the impartial and painstaking scientists who conducted the investigation, such a contamination of the milk of any dairy cannot be prevented by any means known to science, unless the milk shall be properly pasteurized or sterilized. This episode in the history of scientific dairying has been dwelt on in this paper because it occurred so recently and was so thoroughly investigated. Other similar occurrences have been reported from time to time in this country and abroad. Some years ago I was interested in a study of the spread of a mild form of diphtheria by the milk of one of the best dairies anywhere, which is the pioneer "certified milk" dairy in America. The investigation seemed to prove without question that the diphtheria was spread by the milk of this dairy, although every known precaution (except pasteurization) had been observed in preparing the milk for market.

Mr. Nathan Straus and many others, including the scientific man of whom I have been writing, agree with Professor Sedgwick and the other investigators of the Boston epidemic in asserting that milk cannot be guaranteed to be free from pathogenic germs (including those of tuberculosis) unless it has been pasteurized.

Some physicians hold that pasteurized milk has lost some of its most valuable nutritive qualities, so that its constant use may produce rickety babies; and furthermore, that pasteurization may be a bad thing because, by covering up nastiness in the milk, it will encourage lax and dirty methods in producing and transporting milk. While it must be admitted that there is a certain amount of truth in these objections to pasteurization, those who favor the universal pasteurization of milk have, so far at least, the better of the argument.

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While the matter was being discussed the other day, our dairy doctor pointed to his own child, a ruddy and round little girl of 4, and said, "Do you see anything rickety about that child? She has never had any milk since she was weaned that has not been pasteurized, and she has had very little other food of any kind." And so far as the objection goes that pasteurization may be a cover for careless or dirty dairying, no good dairyman will allow his milk to be dirty and trust to subsequent heating to conceal that dirt. Even if he were disposed to do this, the methods adopted by the milk company of which I am writing, which will be presently described, will effectually prevent such a fraud on the milk consumers. Having made up his mind that milk must be pasteurized before it can be guaranteed, the question how this could be satisfactorily and economically done immediately confronted our dairy expert. He had heard that brewers pasteurize their beer at the breweries, after it has been bottled, and immediately proceeded to investigate the process to find out, if possible, whether it could be used to advantage in pasteurizing milk. As a result of his study, he has installed one or more pasteurizers, similar to those used by the brewers, in which all the milk from his creamery is pasteurized after it has been bottled and a metal cap has been clamped on the bottle, just as the cap is clamped on the bottle of beer. This cap, with the date of the pasteurization plainly stamped on it, is not to be removed until the milk is used for food; so it cannot be contaminated or sophisticated in any way between the creamery and the consumer's table.

Now I have briefly outlined the fundamental principles on which clean and cooperative dairying can be carried on and milk produced and sold at a profit at 9 or 10 cents a quart.

Of these fundamentals, the most important one, however, has only been hinted at. It is necessary therefore, to enlarge on it somewhat more fully.

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It was said above that the main factor in the production of safe and wholesome milk at a moderate price is the dairyman. I have spoken of the injustice and futility of expecting the farmer to produce a higher-grade milk at an increased cost and no allowing him to participate in the increased profit accruing from its sale. Yet no one appreciated, until the experiment was actually tried, how potent a factor this same farmer is in the production of milk of a satisfactory quality. When our dairy doctor got his creamery started, he refused to accept milk having a bacterial content of over 10,000 per cubic centimeter, and all his farmers brought him milk just below that count, but never much below it. After thinking this over for a while, the bacteriologist in the company's employ spoke to one of the farmers about it and was surprised at the reply that there was no object in bringing cleaner milk, so long as the milk they were bringing would be accepted. Then the creamery adopted another device. It offered $40 a month in prizes, $25 first prize, $10 second prize and $5 third prize, to the farmers bringing the milk that had the smallest bacterial content during the month. A great rivalry at once arose amongst the milk-producers, and men whose milk had never shown a bacterial content below eight or nine thousand immediately began bringing milk having only a few hundred bacteria per cubic centimeter. The farmer was not told that he must wash his hands carefully between each milking and carefully wash the cow's flanks and udder and sprinkle the stable floor with water before milking; but under the stimulus of the prize and the chance of surpassing his colleagues, he "got busy" and found out all these things for himself and put them into practice; and again the results have been most expectedly satisfactory to all concerned.

These farmers were not ordered to have their cattle tuberculin-tested; they were paid to do it. They were given one-half a cent a quart more for their milk if it

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was brought from tuberculin-tested cattle. They were also given one-quarter of a cent a quart if their bacterial content were less than 10,000 per cubic centimeter. They were also given 4 cents a can (1/10 of a cent a quart) for every "point" above 3.5 per cent. of butter fat (a point being 0.1 per cent.) and they agreed to pay a penalty of 1/10 of a cent a quart for every "point" below 3.5 per cent. of butter fat in the milk delivered at the creamery.

Now we have a nearly complete cooperative scheme in which the farmers and the creamery are equally interested. The creamery, of course, belongs to the company and all the pails and cans used in holding and transporting the milk are sterilized at the creamery. The farmers get their sterile utensils at the creamery every day and bring them back the next morning filled with milk, leaving them there and taking others away with them for use that night and the next morning.

The bacteriologist is employed by the company and every day he examines every farmer's milk and posts the results on a bulletin board where everyone can see them, so that the farmers all know exactly where they stand and where their competitors stand every day of the month, and who is likely to get the prizes; and if a man fails to keep up his record, he and his neighbors immediately know it and generally can find the reason. The practical benefits of this daily supervision of the milk were strikingly shown not long ago. A farmer one day brought in some milk that showed a greatly increased number of bacteria above his average count. When this was pointed out to him he had no idea of the cause. The bacteriologist, according to his custom, hastened to the farm and inspected the herd. He found three cases of garget, an infectious disease of the cow's udder, which is supposed to convey scarlet fever to human beings who may drink the milk of the affected animal. These three sick cows were immediately isolated and a possible infection of the whole herd

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was prevented, as well as a possible epidemic of sickness among the consumers of the milk. It is easy to imagine that many human lives might have been saved had this custom of daily bacteriologic examinations of all the milk from every dairy been carried out in the past. It is so useful, so simple, and so practicable, that it does not seem unfair to predict that the dairy laws will eventually enforce this precaution in all creameries and public milk stations.

On another occasion a farmer brought to the dairy some milk showing an extraordinarily large bacterial content. At first he stoutly denied any known cause for this, but, on being cross-questioned, acknowledged that he had bought some milk from a neighbor and turned it in as his own. So an attempted fraud was discovered and frustrated.

Now we see some of the benefits to which cooperation in the dairy business and milk business leads.

1. A comparatively high and safe grade of milk produced at a price within the reach of practically all users of milk.

2. A contented and intelligent body of farmers producing this milk and getting a tangible reward for their improved methods. As they are now beginning to see the advantages of cleanliness they are beginning to practice it assiduously and to believe in it. Instead of looking on health and sanitary regulations as an imposition and a hardship, they are cheerfully carrying them out and are taking pride in their work, and they are also reaping a pecuniary reward, as it is just and proper that they should. This cooperative dairying has opened a new vista before the farmer and has instituted in his business methods and ways of thought an improvement that promises great things for the future. The dairyman has had a hard time for many years, and the result has been the poorest milk that he could get the milk companies to accept, with the consequent large infantile sickness and mortality in all our cities.

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The attempt to make him produce high-grade milk by passing ordinances has proved as futile as the long continued attempt, so popular in this country, to make people moral and abstemious by law. Education, an appeal to the farmer's self-respect and an assurance that he will be a participant in the increased remuneration for furnishing milk that is safe for a baby to drink, will inevitably work out a revolution in the milk industry.

Our dairy doctor is an unquestioned philanthropist and his efforts will tend to raise the whole milk-producing business from its present low and unsatisfactory state into a profitable and respectable — I might almost say, a scientific — calling that may well engage the entire time and thought of any well educated and refined young man or woman.

42 Church Street.

ABSTRACT OF DISCUSSION

DR. ARTHUR R. REYNOLDS, Chicago: It has been pretty well demonstrated that farms can produce any kind of milk that is wanted, if they are paid for it as they should be.

With all the papers, ordinances and things that are read and passed, very little has ever been said about the age of milk. It is well known that milk has germicidal properties up to the time that it is about 6 hours old, and also that cows are milked every twelve hours. A great many people in the country and smaller places can get their milk every twelve hours; every city should get some of their milk every twelve hours.

DR. MALCOLM C. ROSE, New York: It was not quite clear what kind of cover or fastener Dr. Newton suggested to hold the cheesecloth in place. Many farmers would like to know of such a simple device to produce clean milk, rather than go into all the detail required for qualification for the certified class.

DR. J. JOSEPH KINDRED, Astoria, N. Y.: There is an important relationship between what Dr. Newton has said as to the price of milk which the farmer gets and the price which the consumer has to pay. And this brings out the point that there is no economic, basic foundation for the fact that the poor consumer and the starving parents of sick babies have to pay the price that they are now compelled to pay. In other words, there is no relationship between the law of

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supply and demand; and even if the farmer is able to sell his milk at a fair profit, the consumer ultimately has to pay an outrageous profit; and we understand, of course, the reason for it; it brings up the very broad proposition of the regulation of the trusts.

DR. JOSEPH GOLDBERGER, Washington, D. C.: I think we all agree that we want primarily a pure milk; and we all will agree that there is a possibility of obtaining it; but the difficulty in practical life is to keep it pure during its transit from the cow's udder to the mouth of the consumer. Now, while this may theoretically also be possible, as a matter of practical fact it is only too frequently not attainable, and therefore we must try to take such measure or measures as will insure a supply of milk, safe in the sense of being free from disease-producing organisms.

There can be no question but that pasteurization does make milk safe. Some of the objections to pasteurization to which Dr. Newton referred undoubtedly are valid; but as he also well pointed out, when weighed against the points in favor of making the milk safe to the consumer, they must fall out of practical consideration. To emphasize, therefore, I simply want to say that we must pasteurize our milk, at least in large cities, to increase the chances of the consumer getting a safe, disease-free milk. Speaking for myself, I have not, in my own family, altogether confided in that; I am speaking now of commercial pasteurization. I do not entirely trust milk even after it has been commercially pasteurized. In my own family I invariably use boiled milk; and I am bringing up two vigorous youngsters in that way. They have never had any milk (except their mother's for a short period in infancy) that was not boiled, and I do not believe that boiled milk has hurt them in the least.

DR. J. J. KINDRED, Astoria, N. Y.: May I ask Dr. Goldberger if it is possible to sterilize the whole quantity of milk consumed in the city?

DR. M. P. RAVENEL, Madison, Wis.: I would like to combat the wide-spread idea that pasteurization destroys the nutritive value of the milk and produces scurvy and malnutrition in children. Pasteurization must always be a temporary measure and should not be advocated to take the place of clean milk from healthy cows. It seems to me that one can liken the case to the choice between a pure mountain spring and filtered water from a cesspool; theoretically, the filtered cesspool makes a safe drinking-water, but people do not want it, and it is better to take a water which is pure at its source. In the same way it is better to have pure certified milk than pasteurized. Nevertheless, pasteurization is a great safeguard and should be adopted where an absolutely clean supply cannot be obtained. The charge that pasteurized milk produces scurvy has been answered repeatedly. I once heard Dr. Isaac

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A. Abt, in reply to such an accusation, say that he had seen children with scurvy who fed at the mother's breast, which is unquestionably true. I wish to emphasize the value of pasteurization as a measure for the protection of children against diarrheal diseases and tuberculosis and to say further that it does not interfere with the nutritive value of the milk.

DR. RICHARD COLE NEWTON, Montclair, N. J.: I have always had a prejudice against pasteurization of milk. I was brought up in a community where it is the custom to cry down this process, saying that it may produce scurvy in children. In these days, babies are getting a more liberal diet than formerly. We tell mothers to give them apple sauce and so on, earlier than we used to do. Like Dr. Ravenel, I have seen very little scurvy or rickets of late, and it is almost criminal for a man to have much of them in his practice, because they are so easy to avoid.

One or two of the discussers have asked how the cloth diaphragm is used. One farmer, who had a dirty old barn and was very poor, just took a clean rag and tied it with a string over the top of an ordinary open pail. He took his milk to a hotel which used a lot of milk, and his milk was found to be the cleanest of any that was brought there. The milk-pail that was originally used had a cover that fitted on the top like the cover on any kind of a pail. There was a circular opening in the cover 3 or 4 inches in diameter, across which the cloth was stretched. There was a rim around this opening about 2 inches high and a cap or ring, pushed down over this rim, held the cloth fast. The cloth was renewed for every one or two cows. It has been found as good or nearly as good to use a metallic hood over this opening, and when the men milk, the stream of milk is directed horizontally into the pail. Cloth diaphragms are not used in some of the large dairies nowadays. Nearly all the dirt in the milk comes down out of the air as dust and may be arrested on the top of the hood.

Dr. Reynolds spoke about the length of time between the milking and the delivery of the milk to the consumer. Unfortunately, in New York City it does not seem possible to get the cows and the children very near together. It was said that years ago an experiment was tried in Paris on foundlings, nearly all of whom were syphilitic and practically all of whom died very young: female asses were driven up to the foundlings so that the children could suckle them, with the result that many of them lived—a striking illustration of the advantage of feeding babies warm milk. There is no question about the enormous advantage of this procedure, but in New York and Brooklyn it seems impossible; so we have to rely on pasteurization. Milk can be sold at a profit when sold in the manner described in my paper—at 10 cents a quart; that is about as cheap as clean milk can be produced.

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